WORK

An Illustrated Journal of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

A PARIS newspaper is being printed from type made from glass, and the results are reported to be gratifying. It ought to furnish very light reading.

* *

A sky-cycle, or wheeled flying machine, the invention of a Boston man, is to be exhibited at the Chicago Exhibition. Who will try it?

* *

Under the regulations of the Science and Art Department, 1,170,340 pupils were taught drawing in 6,211 elementary schools last year.

* *

The new mode of constructing steel buildings at Chicago has created a new industry. Employees have already their organisations under the term, architectural iron-workers.

* *

A new iron bridge over the Farrar, in Strathglass, Inverness, lately collapsed, with a cart of about one ton going over it! The rivets were cut as clean as a razor would slice a potato.

* *

Buildings erected at Chicago are no less than seventeen stories high. The peculiarity is the rapidity with which they are built, as only three days and a quarter are occupied in building solidly and completely one floor with its numerous rooms.

* *

An automatic arrangement in connection with the telephone has been recently devised, with a view of increasing its usefulness. Communication with the chief office is secured by putting a penny in the slot. If the line is occupied, or the person called is absent, the money is returned by the machine.

* *

In some of the ancient temples of Egypt—known to be more than four thousand years old—the stones were dowelled together with hour-glass shaped ties of the Timarish or Shittim wood, the dowel sinks being only about 1 in. deep. This wood is not now in the market, but some of the timber from Australia and New Zealand approaches it very nearly in general properties.

* *

A test has been made of a "Harveyised" nickel-steel armour-plate 8 ft. by 6 ft. and 10½ in. thick, weighing 18,000 lb. Five rounds were fired at the plate; the shot weighed 250 lb., and was thrown from an 8 in. rifled gun by a charge of 81¾ lb. of powder, giving a velocity of 1,700 ft. per second. The skin of the plate was pierced, but no crack was visible. The projectiles rebounded from the plate in fragments.

* *

"Semakuir," a Finland stone, turns black before a fall of rain, while in fine weather it is mottled with spots of white. Analysis shows this stone to be a fossil mixed with clay, and containing a portion of rock-salt and nitre. The salt, absorbing moisture, turns black when the atmosphere is supersaturated with aqueous vapour, and a dry air brings the salt, in white spots, to the surface.

* *

The Pinna, or wing-shelled bivalve, found chiefly on the coast of Sicily, is unquestionably a silk-spinner. Its silky filaments, by which it attaches itself to rocks, are extremely fine, and, after being washed, are spun, in the ordinary manner, into fabrics of very delicate texture. This material was known to the ancient Egyptians, who used it in the manufacture of mummy cloths. A veritable sea silkworm.

* *

The world's output of coal is about 488 million tons, divided as shown. The quantities stated are for 1890, unless otherwise noted :—

	Million Tons.
British Islands (1891)	185
United States (estimated 1891) ...	141
Germany	90
France	28
Belgium	20
Austria	9
Russia (1889)	6
Others	9
	488

* *

Experiment has shown that it is not indifferent, from the point of view of longevity of an incandescent lamp, to place it in any position whatever. Particularly for those which have fine long filaments, the horizontal position is not suitable; still less that which is adopted with a decorative aim, and which consists in inclining the bulb upwards. In buildings subject to vibrations, the lives of the lamps are considerably shortened if care is not taken to mount them judiciously.

* *

One hundred years since, Murdoch hit upon the application of coal-gas to purposes of illumination. He placed some coal in a tobacco pipe, and, plugging the bowl, put it in the fire and lit the gas issuing from the stem. Subsequently he lighted his offices at Redruth with coal-gas, and invented a method of extracting colouring matters from coal-tar. His steam road engine, on which he travelled from mine to mine, solved the question of steam locomotion twenty years before George Stephenson applied it to railways.

* *

Piles—23 ft. long—for the new Blackpool pier are driven by water pressure at a rate of 20 ft. in fifteen minutes. They are set in position by a pair of shear legs, and a suitable connection is screwed on the head, to which a hose pipe is connected from the steam pump. The water is forced down the inside of the pile, and being turned at the same time by levers clamped to the side of the pile, is forced down through the sand. The levers can be raised as the pile is screwed down. For screwing the piles into the clay, longer levers worked by a chain and windlass are used.

* *

A new smokeless powder—apyrite—with valuable properties, has recently been experimented upon in Sweden. It is a nitrate of cellulose, and the properties claimed for it are that it burns without a flame, it does not heat the gun in which it is fired, it can be handled and transported without danger, and is not affected by damp or heat. A gun from which 800 rounds had been fired with this substance was put aside without being cleaned, and when examined eight days afterwards was found as clean as before. Fifty grains of apyrite give an initial velocity of 2,100 ft. per second, with a pressure of 30 lb. per square inch. War Office—note!

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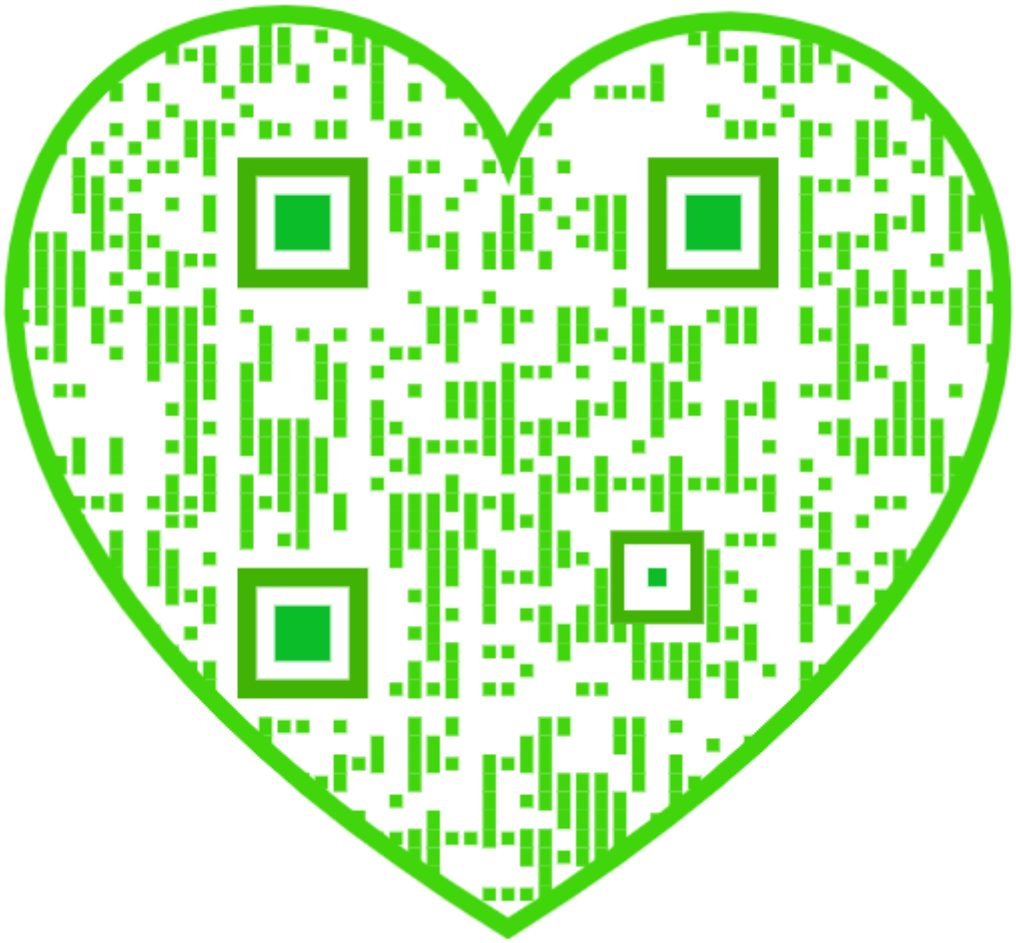

A PORTABLE EASEL.

BY OPIFEX.

ADAPTABILITY — MATERIALS — CONSTRUCTION — FRAMEWORK—HINGED PROP—SIZE—FINISHING WOODWORK—BRASS CLIPS.

THE easel represented in the sketch (Fig. 1) is of very simple construction, and possesses some useful qualities. When closed it forms a good table easel, and when raised it is of a convenient height for sitting at. It is also very suitable for travelling, and may be carried carpet-bag-wise on "the tramp." I shall not occupy valuable space in a minute description of the details of construction, trusting to the accompanying drawings to guide the reader who may be disposed to make this article for himself.

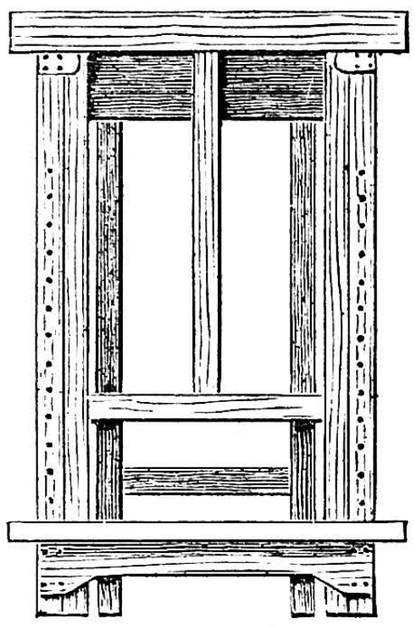

Fig. 2

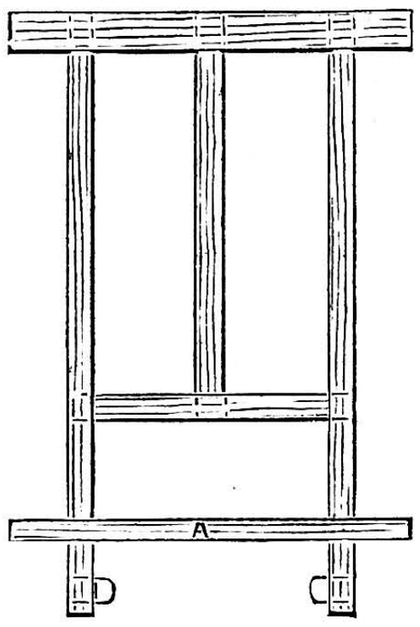

Fig. 3.

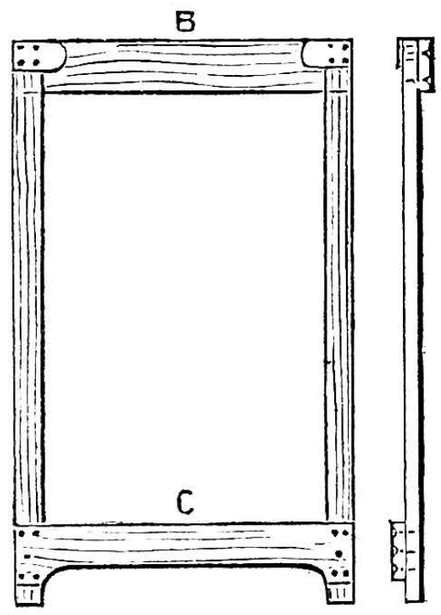

Fig. 5.

Fig. 6.

Materials.—Easels are, I believe, generally made of pine or mahogany, but I think that good straight-grained ash is better for one of this kind, which is meant to stand a good deal of knocking about; and, as it allows of much smaller scantlings being employed, the difference in weight will be very slight, and will be more than compensated for by the advantage of much greater strength.

Framework.—The easel consists of two frames (Figs. 3 and 5), sliding one (Fig. 3) within the other (Fig. 5), the frames being held in position by the cross-pieces A, B, C in the respective Figs. A also serves as a support for the picture, etc., while painting, and may consist of a plain slip, as at Fig. 1, or, better, formed of two pieces, as shown at Fig. 4.

Brass Clips.—As the cross-pieces are not alone sufficient to hold the frames together, two pairs of brass clips are required, one pair being placed at the upper ends of the outer frame (Figs. 2 and 5), the others at the back of the lower ends of the inner frame (Fig. 3). These clips should be of $\frac{1}{16}$ in. brass, and of the shape shown at Fig. 8.

Prop.—The easel is supported by a framed prop (Fig. 7), which is attached to the lower edge of the upper cross-piece, B (Fig. 5), by means of a pair of suitable brass butt hinges. With the exception of the cross-pieces, the frames and prop are of $1\frac{1}{8}$ in. by $\frac{5}{8}$ in. stuff, which should be well-seasoned, dry, and straight-grained ash. The top piece of the easel may be shaped as suggested in the sketch (Fig. 1), or made plain as in the other drawings, according to taste, but it should be at least $2\frac{1}{4}$ in. wide by $\frac{5}{8}$ in. thick. The cross-pieces B and C (Fig. 5) should be at least $2\frac{1}{2}$ in. wide by about $\frac{3}{8}$ in. thick, and are attached by gluing and screws, as indicated; and if C is shaped as shown at Fig. 5, the ends being about 3 in. wide, it will give more rigidity to the frame. The easel may be made any size.

Finishing Woodwork.—Careful work will be necessary, and the mortises and tenons—indicated by dotted lines in the various cuts—should be accurately made, as the success of the undertaking, which means the rigidity of the easel, depends upon such good work. The several parts should be well cleaned up with a sharp, closely set trying plane, and finished with finest sand-paper. With regard to the treatment of the finished surface, the frames, etc., when made, and before putting the parts together, may have two coats of very hard-drying varnish and be allowed to dry thoroughly, or they may be French-polished or simply oiled.

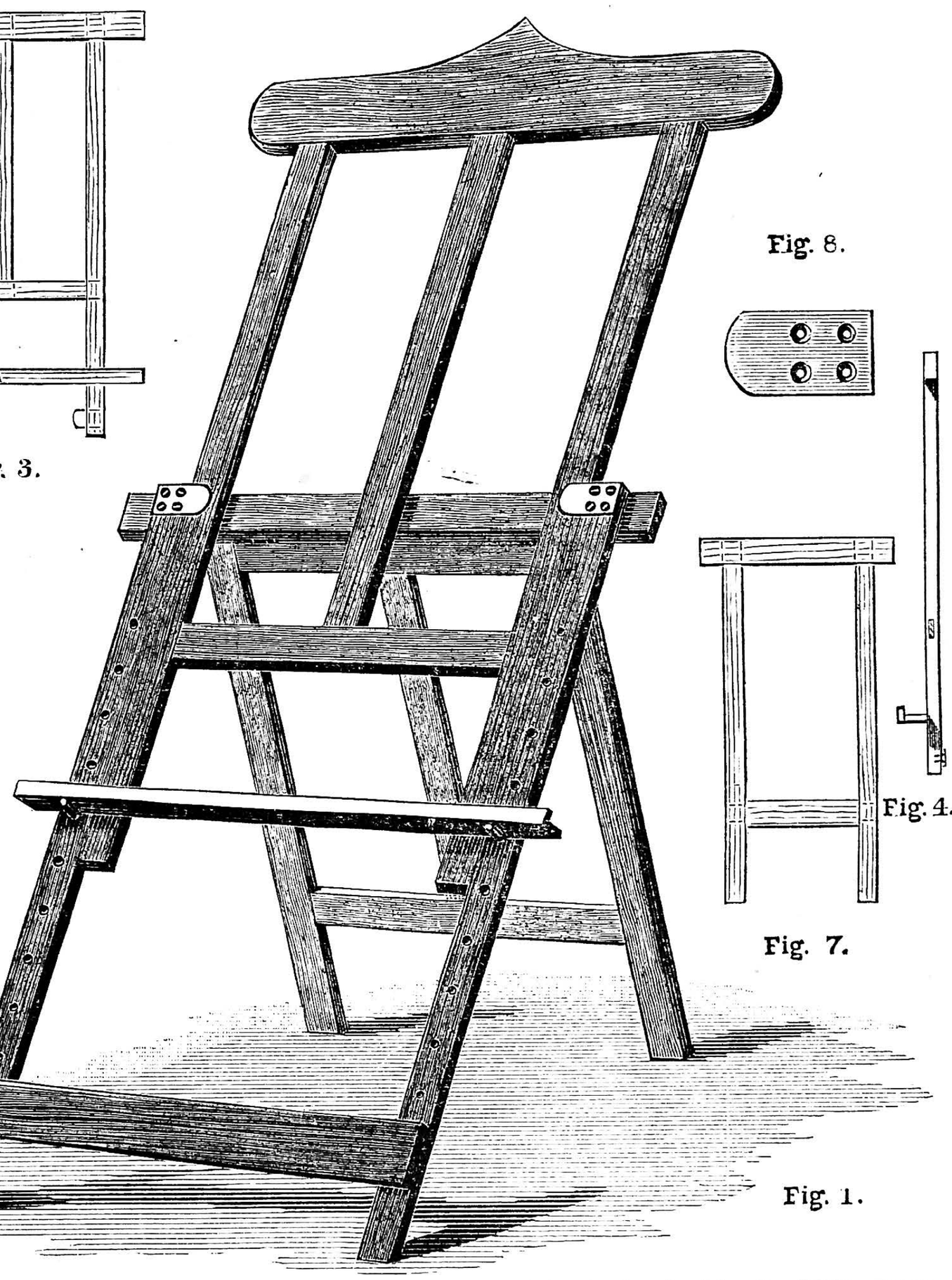

Fig. 1.

Fig. 8.

Fig. 4.

Fig. 7.

A Portable Easel. Fig. 1.—Perspective Sketch of Easel. Fig. 2.—Front Elevation of Easel closed. Fig. 3.—Ditto, Inner Frame. Fig. 4.—Side Elevation, Inner Frame. Fig. 5.—Front Elevation, Outer Frame. Fig. 6.—Side ditto, ditto. Fig. 7.—Prop. Fig. 8.—Brass Clip (four).

GOLDSMITHS' HALL: THE GOLDSMITHS' COMPANY.

BY A WORKING GOLDSMITH.

IN a magazine like WORK, whose aim is to be useful to workmen of all kinds, we do not feel that our duty is properly carried out by merely advising this or that workman on a technical difficulty, or by printing special articles of interest to the different trades. We hold to the idea that our position is one that calls for more than this attention to the needs of to-day, and we feel that we should clearly and distinctly speak out whenever we can see an opportunity of obtaining better facilities for the coming race of workmen: hence this series of articles to the City Companies.

For this reason we naturally give all the support and publicity we can to the classes held in technical education; and this support is not based on theoretical grounds, either, for in the mass of correspondence that comes to us from all parts of the world we have a tangible proof that men are glad to be able to refer to some centre where their doubts and difficulties will be carefully considered and answered.

From our experience, we feel ourselves to be in a position to point out a practical course to the City Guilds—one that they should consider well—for it is to them the various trades should look for guidance and help.

The City Guilds are Companies which have been formed for the purpose of pro-

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moting the interests of the particular trade or calling to which the members belong. Since that is, or was, their origin, we, in this paper, who regard things from a workman's point of view, are naturally interested in the way they have been fulfilling the object of their existence; and we have lately been prosecuting inquiries with regard to the Goldsmiths' Company to that end.

Our information, being derived from the working members of the trade, may not be an exact report of the present state of things; but it will be an unbiassed report of things as they are believed to exist by such workmen.

In this article we will try to clearly set forth the view taken by the jewellery and silversmiths' trades of the Goldsmiths' Hall.

In the first place, it is mainly known as the place where the goods are sent to be hall-marked. That branch of its work we can leave out of consideration, for it has no bearing on our view of the subject.

In the second place, it is heard of as a munificent donor to trade charities.

In the third place, as the founder of a polytechnic—the Goldsmiths' Institute at New Cross. This institute is for general instruction, however, and has no special bearing on the trade matters that we are interested in.

With regard to the two last items we have nothing but praise; and it is to further an evident wish of the wardens of the Goldsmiths' Hall to assist the cause of education that we ask them to consider what follows, for it is based on thoughtful inquiry.

The first and most important step for them to take is to bring themselves in touch with the trade; at present they are not in a position to get their good deeds known and appreciated. We can give, as an instance of this, the trade's almost absolute and entire ignorance of the opportunity of learning drawing which this Company provided at Clerkenwell for many years. Then, again, there are the valuable prizes offered through the Society of Arts. Is it any wonder that they failed to raise the interest of working jewellers that could compete when not one in five hundred ever heard of them? Why not advertise in WORK?

We can make allowance for some lack of interest on the part of a guild when its prizes are passed by in an apparently contemptuous manner, although it is brought about through an oversight or fault; for as no notices ever reached the trade, a response could hardly be expected.

If the Goldsmiths' Company wish to do anything, they must let their ideas be known; and surely it would not be difficult to let notices be sent to members of the trade, even if the members of the Company cannot themselves help to spread the announcement of that prize or this competition that they institute.

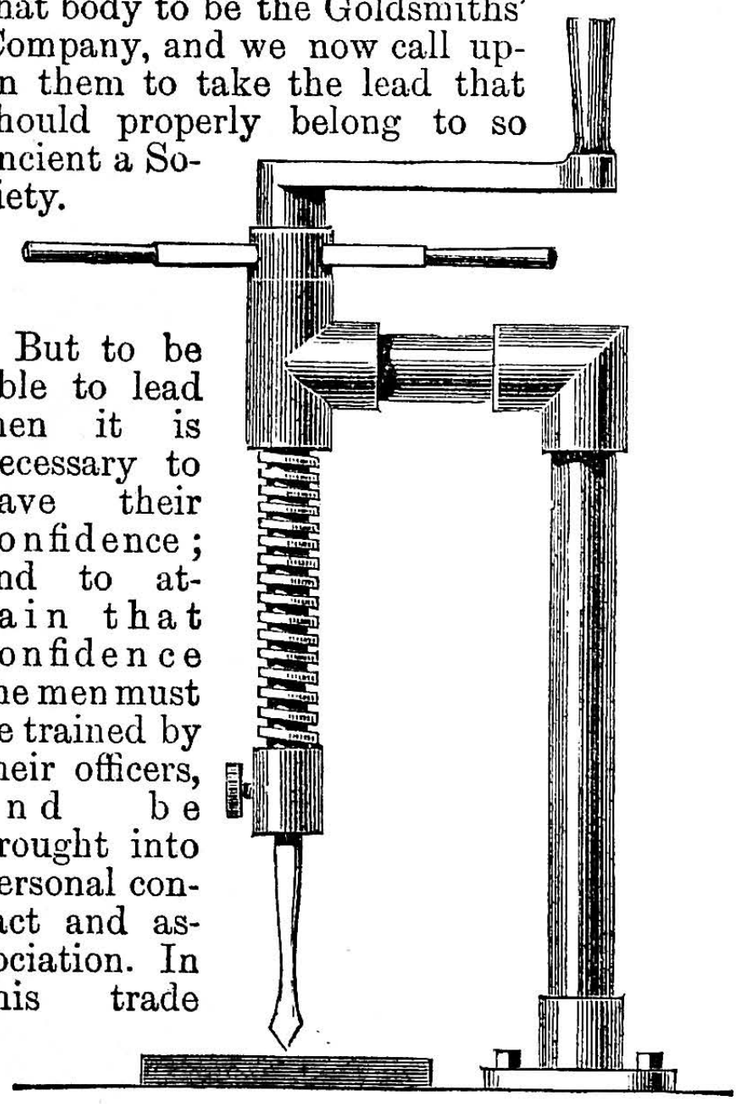
We have not been able to find out how many actual members of the trade are now members of the Goldsmiths' Company; therefore, we cannot say how far such personal influence will go. If there are so few—and it is that we rather fear—then, can they not call a meeting of the trade together to consult and consider what should be done? In this they would have plenty of precedents: from Parliament and the Imperial Institute downwards.

We understand that there is an Association of Jewellers and Silversmiths at Birmingham which has taken the lead in providing technical and artistic instruction. Surely, what they can do in the country we may ask the premier trade fraternity to do in London—if merely as a matter of justice to the trade whose name they bear, and whose interest they were founded to advance!

The opportunity they now have in their hands is one that should be proudly and gladly seized by them; for in London there is hardly anything being done to equip the young workman for the tussle he will soon have to enter on with his technically instructed rivals from France, Germany, and even our own large provincial towns.

Even what has been done in this direction in London is due to the Polytechnic, in Regent Street; and while acknowledging the energetic and successful way they have set about all kinds of education, still, it is almost a matter of self-preservation, and is certainly important enough to be taken in hand by the most powerful representative body that any trade possesses. We take that body to be the Goldsmiths' Company, and we now call upon them to take the lead that should properly belong to so ancient a Society.

But to be able to lead men it is necessary to have their confidence; and to attain that confidence the men must be trained by their officers, and be brought into personal contact and association. In this trade the leading men are not known, except by name, and are not likely to be, as opportunities are only given at trade dinners, the cost of which bars those on whose behalf we write.



Amateur's Drilling-Frame.

It does not appear to us an insurmountable difficulty to get in touch with the trade: it has been done with other City Companies.

In the short space at our command we cannot enter fully into details; but from our informants we arrive at this conclusion—viz., that opportunity should be given to young jewellers to see the many allied branches carried on—as is done, we understand, in Germany. By seeing (and practising too, if he will) any one branch, or all of them, he will be given a double chance of succeeding in life—for he may find he possesses talent for a class of work—quite different from that he happens to be doing at the present time; and besides, he will be better fitted to work single-handed, as many have to do in our own country places and in our ever-extending colonies. Such knowledge as may be given at a technical school may—nay, will—go far towards reducing the number of journeymen who are more or less like machines, able to make only one or two articles properly.

This article will not be complete without a reference to the two subjects now included in the programme of the City and Guilds of London Institute for the Advancement of Technical Education. We refer to silversmiths' and goldsmiths' work. The latter has but been in existence for one year; the former for some five or six years. And much as we regret the failure of classes in silversmiths' work, we are not surprised, because we cannot find that any trade influence is exercised to support the teachers.

If the Goldsmiths' Hall will but take up the syllabus as it is issued by the City and Guilds Institute, and get it put into practice, we have but little doubt that a year or two's experience will do much towards improving it; and, even as it is, it will put such junior members of the trade as wish to improve themselves on a level with, or even in advance of, continental workmen.

Are we asking too much of so important a body as the Goldsmiths' Company? We hope and trust not; and we may surely beg them to take steps—other than the mere giving small sums of money—to smooth the road for such working members of the trade as are willing to improve themselves if they get the chance, but who are, from their humble position, unable to bring any pressure to bear; and even if they could be heard, and their requests granted, still, it is not to be expected that they would be the best judges of their wants and requirements: for to decide on a course of education older heads are wanted; and the council to direct this can be assembled, if their trade guild but wills it. We trust that it will. To let the lead, in such a matter as this, pass into the hands of a provincial town—even such an energetic one as Birmingham—is not a condition of affairs that should be in existence. Nor do we expect that the Goldsmiths' Company will let things rest. Let them show that they are the guardians of the goldsmiths' trade.

AMATEUR'S DRILLING-FRAME.

BY J. T.

THIS drilling-frame may be readily made by an amateur. It is formed of wrought-iron gas or steam pipes and fittings. The lower portion on which it rests is a flange which has four bolt-holes in it, the top part being screwed. Into this is screwed a piece of pipe of the required length; upon this is screwed an elbow, with another short length of pipe screwed into it, and on the outer end of this a T-piece is screwed; the T-piece should have the tap run right through it, as sometimes a portion in the centre is left unscrewed. The screw for feeding the drill is a short length of pipe screwed right down the outside. The inside should be rimed out with a parallel rimer, and the drill spindle turned and fitted to slide in it. On the top of the screw a double handle for turning it is fixed. The lower end of the drill spindle is made larger, and bored for the drills to fit in, and a handle keyed on the top; the drills are prevented from turning by a small set-screw at one side. The flange is bolted down to a bench, and in order to give more width for drilling a parallel block of wood is fixed under the drill. The size of the pipes should be suitable for the size of hole to be drilled, but pipes 1¼ in. or 1½ in. outside diameter will be a fair average size. The T-piece may be a forging, if it cannot be screwed right through.

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BOOT AND SHOE MAKING.

BY WILLIAM GREENFIELD.

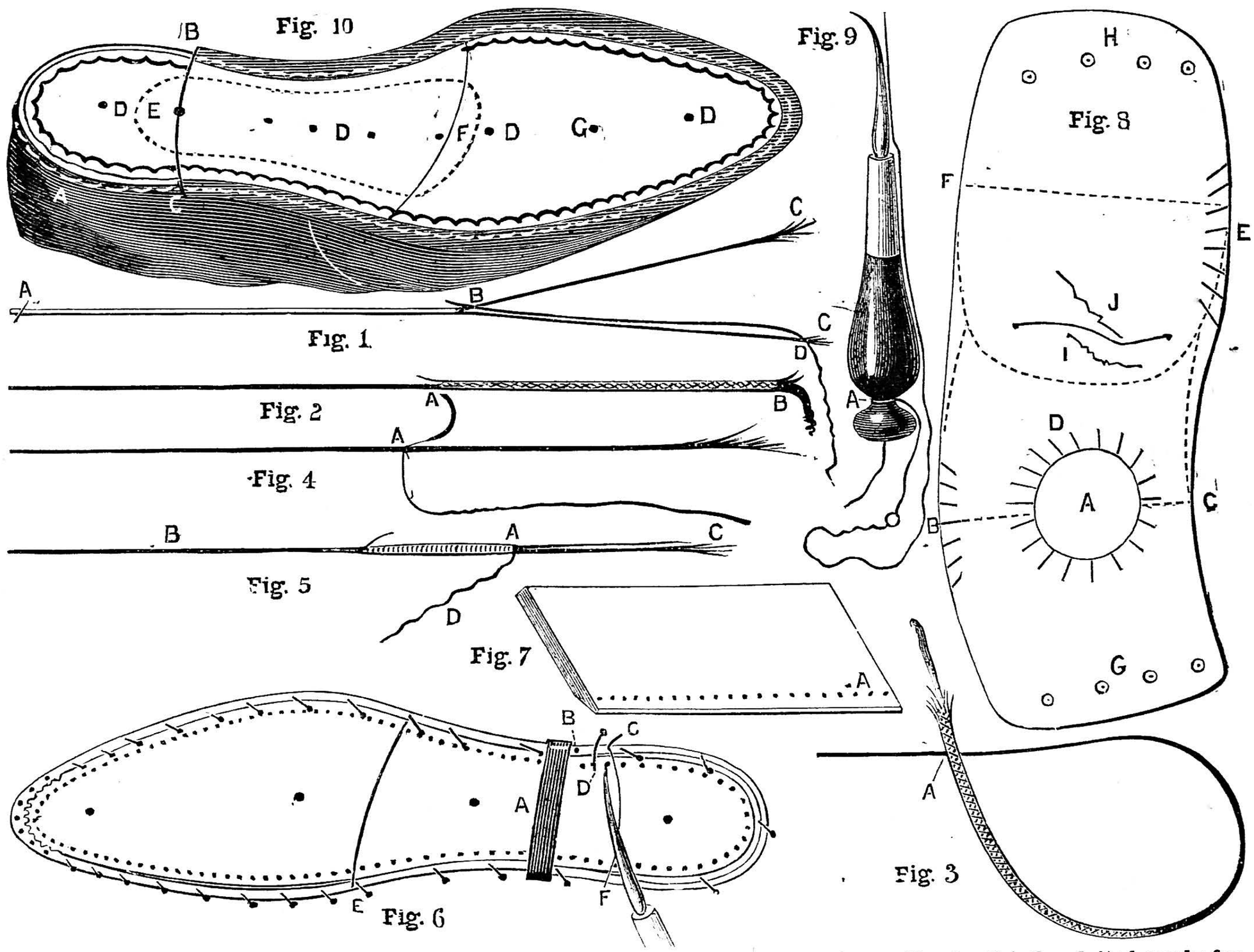
HOW TO PUT THE BRISTLES ON—HOW TO SEW IN THE WELTS — METHOD OF FILLING UP THE BOTTOM.

How to Put the Bristles on.—For a sewing thread you want not only a good pair of bristles, but—as they so often have to pass through a soft inner sole, a linen lining, and various other substances—a stout pair. Therefore, pick a stout transparent pair, from A to B (Fig. 1). On the end of each bristle there is a dry, glutinous substance. This is the part that is in the hide when on the animal, and is of no use for our purpose. This, therefore, is cut off in a slanted direction, as shown by the line across it at A.

When the two points are made in this way, put them together, and hold them about 1 in. from the end, and rub them up and down on a piece of sand-paper, somewhat in the same way that you would use a paint-brush, only, at the same time, twisting them round. This will give them a nice round top, which, with a little pressure, will find its way through almost anything we require. Now, just bend the bristles at B against the thumb-nail, and split them both down to this point. This is done by taking hold of the other end, which is bushy, and having equal portions in each hand, as shown at C and C, and pulling them asunder, making a crutch at B. The extremity of the waxed thread you have made is placed between this at B, and held tightly by the thumb and finger of the left hand, the palm of the hand being towards you. Then take the split part of the bristle C, and the thread D with it, between the thumb and finger of the right hand, and twist them together, twisting towards you; and each time you want to take another sweep, hold the part C D, for the time, between the little and third fingers of the left hand, and when it is twisted just tight enough, hold it while you twist C, the other half, in the same way, being very careful not to break or twist it off. This done, you put it with C and D, so that you have C D and C together. These you hold firmly at this point in the thumb and finger of the right hand. Then let go with the left. This will, of course, make A twist round a little. This you twist (in the direction that it is now going) with the left hand, and you have a neat splice, as shown at A B (Fig. 2). It is now changed over, and B held in the left hand. Then through the thread at this point make a hole with a fine stabbing-awl, as at B, and the point of the bristle is put through this eye, as shown at A (Fig. 3). This is drawn through, and then smoothed between the thumb and finger from the point downwards. This is to secure the ends of the bristles, and prevent them from unplaiting. The above method is called "plaiting."

I will now explain how to construct what is called "run," or "twisted on." In this case you do not split the bristle, but wax it from A to B (Fig. 2). For this kind of adjusting, the taper of the thread has to be very fine—in fact, tapered away to *nil*. This is laid across the middle of the bristle, as A (Fig. 4), while it is upon the finger of the left hand, and the thumb is pressed on to it. The thumb is then drawn downwards, pressing very hard, so that the fine point may be twisted round the bristle while it is being rolled round. This you can continue till you get down as far as A, in Fig. 5, which can be done by holding it at A, in the right hand, and twisting with the left at B. Then hold it at A with the left hand, and separately twist C and D, and finish in the same way as with C and C D in the first process. This is done at both ends of the thread, and the two bristles are put together. The thread in this way is halved. At the half it is twisted a little, to know it when starting to sew, and to have both ends the same length in work.

How to Sew the Welts in.—The sewing in of the welt is one of the most important things in boot and shoe making, inasmuch as the ripping of a welt-seam nearly spoils the boot, since it cannot be well repaired without re-welting. This is far from pleasant, if it has to be done before the sole is worn out. Therefore, before starting to sew, see that the thread is well made—that is, nicely twisted, waxed, and smooth throughout. See, too, that it is of about the same substance as the awl to be used, which should be a good and sharp one. It may seem strange to some that the thread should be as stout as the awl, considering that the double substance of the thread has to pass through the hole made by the awl, but it is in the method of using the thread that tends to prove the hole large enough. The way in which the thread is pulled through accommodates it to the hole.



Boot and Shoe Making. Fig. 1.—Bristle and Thread ready to be twisted together. Fig. 2.—Bristle plaited ready for fastening. Fig. 3.—Way the Bristle is made secure. Fig. 4.—Bristle ready with taper end to run on. Fig. 5.—Bristle ready with taper for twisting and finishing. Fig. 6.—Boot Lasted and in position, showing how to commence sewing in the Welt. Fig. 7.—Piece of Welt, showing where to start sewing. Fig. 8.—Hand-Leather, size according to hand. Fig. 9.—Awl and Bristle, showing position while pulling out. Fig. 10.—Section of Boot, showing Welt sewn in, the Shape of Shank-Piece, and place for filling.

Now the welts are fitted, the threads made, and the boot lasted. If it has dried, before sewing, just damp it all round over the holes, and well rub your wet brush (an old tooth-brush) round the heel part, to moisten the edge of the stiffener. Then you can commence to sew.

Your strap should be under the left foot. If a strap is used, put the buckle under the foot; or if a stout piece of cord or rope be resorted to, put the knot under, so that the thread does not catch in it while you are sewing, or it will break it. Place the boot between the legs (which should be held close together) with the toe towards you, letting the strap go over the waist of the boot, as at A (Fig. 6), so as to keep it fixed while it is sewn. The tack at B can now be drawn, and the sewing-awl put in the first hole of the waist, as at C. Fig. 7 is an illustration of the section of the welt under

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process of sewing. It will be seen that it is used grain side downwards, with the side that had the angular piece taken off nearest to the upper. While the awl is in the position shown at C (Fig. 6), the part shown (Fig. 7) is placed upon it, in order that the awl may be passed through it at A. The awl is then withdrawn. The thread being held in the left hand, one of its bristles is put through at A (Fig. 7) and C (Fig. 6). This is pulled through until it has reached the twisted centre of the thread. Then you have an equal length on each side, one in each hand; and now, with the awl in the right and the hand-leather on the left, you are ready to set the first stitch.

A hand-leather is indispensable, but it is very simple to make. Take a piece of leather—the leg of an old Wellington or the top of an old water-tight will do; but, failing these, a piece of new leather, not too stiff—about 8 in. to 10 in. long, and 2½ in. to 3 in. wide, shape it as in Fig. 8, then a third of the way from the end, at the left, cut a piece out about 1 in. in diameter, as at A, 1 in. from B and ½ in. from C, then snip it through at B C and D, as shown by the short strokes. It is then doubled over at the dotted lines, B C and F E. Four holes are made through the two ends, as G and H, and laced together, as at I and J, and made secure. It is then placed over the left hand: C E being the bottom and G H being in the palm of the hand. The thumb is passed through A, and the cuts, B and E, soon permit it forming itself into the shape of the hand.

Now to set the first welt stitch: the awl is put in as before, through the next hole, D, the left bristle is put through just about 2 in., the right follows similarly. The points of the bristles change hands—the left to the right and the right to the left—and they are pulled through simultaneously for nearly half a yard each. This is done by holding the bristles between the thumb and finger (with their points in a direction from the work) with the palms of the hands upwards. When they are pulled a little way out, the hands are twisted round, so as to bring the thread round the hand at the bottom of the little finger, and round again, to be held by the thumb and finger of both hands. The first pull is finished in this way. When the thread (not the bristles—keep these between the thumb and finger, ready to use again) is dropped, and picked up again near the work, another stroke is made. This will, in all probability, pull the whole of the thread through. If not, another pull must be taken; but, anyway, they must be pulled in quick succession until the stitch is set. This cannot be until you have made the final stroke. This is not to pull the thread in, but only as a tightening pull. It must be hard—more especially on the right side, which pulls the stitch into the welt, whereas an over-strong pull on the left may possibly pull the stitch through the in-sole. But to get this extra strong stroke you must wind the left end round the hand-leather on the left hand, and the right end must be wound round the end, or knob, of the handle of the awl, as A (Fig. 9). This done and pulled in tight, the next and all following stitches can be proceeded with in a similar way.

When five or six stitches have been set, the seam can be knocked down with a hammer to make it smooth; but do not hit so hard as to bruise it. While this stoppage in the work is being made, it is well to wax your ends, or at least one of them. It is best to wax only the one on the right side. Set another stitch, and then wax the other, which this time is on the right. This process is adopted because the first time the wax passes through the leather it is very apt to chip off the thread a little here and there, and fly on to the work. If the right side be worked from the wax falls on the inner sole, where it does no harm; otherwise, it would fall on the upper of the boot, and would not only need getting off, but would also spoil the leather, if Russian or any coloured leather. The waxing is done by holding up one end straight above the work with the left hand, and holding the wax in the thumb and finger of the right, and rubbing it up and down quickly and evenly. Then you proceed with the rest of the welt-sewing as above, until reaching the other joint at the commencement of the waist (see E, Fig. 6). Here skive off the remainder of the groin which has been left on the welt, turning it back upon the sole or a piece of thin wood, and skiving it as you did the other end. Then sew it in till you get to the point F. There it is cut off, and the last welt stitch set over it. You will find, however, when you get to the toe, that the boot will need turning round, toe from you; also that it is best to draw each tack, so that the work shall not come unlasted.

Now comes the sewing-in of the seat. If you do not start with a new thread, you must well wax the two ends, which must be long enough to go the whole way round; otherwise, a new thread must be used, for there must not be a join in the thread.

Start sewing in the same way as you did before, but you use no welt; therefore, the stitch on one side will lay on the inner sole, and the other on the upper, as at A (Fig. 10). This sewing you commence at B and end at C, making very solid stitches, and pulling the last end through to the inner sole. Then tie the two ends into a good knot, in order that the finish may be quite solid.

If the seat be sewn in first, you can continue to sew the welt in with the same thread. If the welt is first sewn in, then the boot has now got stitches in place of tacks, and all round there is surplus stuff (upper stuff), which must be cut off quite close to the stitch, but not so that it weakens the seam. The knife must be sharp, and the point dipped towards the inner sole, save at the seat, where it is held a little more flat than with the inner sole. The whole seam can now be hammered down, to make it as smooth as possible.

Filling up the Bottom.—A piece of chalk is rubbed round on the top of the stitches, and a piece of felt laid on top and tapped down all round. This will leave a chalk mark upon the felt, to show the size the felt will need to be. The whole of the inner sole is pasted, and the piece of felt laid on, hammered all over, and then left to dry. It is then trimmed off all round level with the welt. Of course, prior to this the four tacks, D, D, D, D, must be taken out. A piece of leather is then pegged in the waist with about four pegs. It should be good solid leather, and of the size marked out by the dotted line E and F. It should be skived thin at each end and each side, so as to leave it thick in the centre only. This piece of leather is pasted, and a thin piece of felt placed over it. This can be done by warming the felt and splitting it. If the bottom is at all hollow at G, the felt must be pasted, and another layer put in the same way as the first; but it only wants to be just level with the welt. By this time the whole surface, from heel to toe, should be quite smooth, and when a sprinkling of powdered French chalk has been rubbed in it is ready to receive the sole.

PHOTOGRAPHIC BACKGROUND SCENERY.

BY WILLIAM CORBOULD.

A correspondent (A. E. A., *Suffolk*) has asked for information on a subject which cannot be treated in the limited space of "Shop." Hence this brief article.

In the first place, the material for painting on must not be less than 6 ft. wide and 8 ft. high, and should be in one piece—that is, without a seam. The calico sheeting or canvas must be two yards wide. I can send it for 1s. 1½d. per yard—the proper canvas for painting on—should he not be able to get it.

Secondly, get some battens, say about 2½ in. wide and 1 in. thick; let two be 7 ft. 10 in. long and two 6 ft. 3 in. long; place the two short ones on top and bottom of the two long ones. Put two nails in each corner, about 2½ in. long (see Fig. 1); you need not drive them right home, they will be easily taken out after the painting. The frame should be 8 ft. high and 6 ft. wide, and perfectly square.

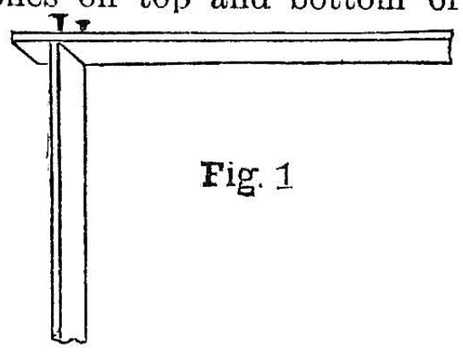

Fig. 1

Fig. 2.

Photograph Background.

Now tack your canvas on the frame by tacking the two top corners, then the two bottom corners; stretch it moderately tight. Now tack the top and bottom centres, then the sides; keep dividing the centres until the tacks are about 6 in. apart. It will now be ready for priming.

There are several colours which may be used for photographic backgrounds, but space here will not admit of their treatment. I shall only deal with one, and the simplest.

Have about 4 lb. or 5 lb. of whiting; break it up, and put sufficient water to it to just cover it. When soaked, drain off all the water you can. Have now 3 lb. of jelly size, and put it on the fire with about a pint of water; melt it, but do not let it boil. Pour this over the whiting, well mixing it to about the consistency of castor-oil. We must now have a little vegetable black; mix this with a little water into a paste. Now a little celestial blue must be mixed in the same way as the black. We are now ready to start painting.

A single tie brush, about 10 oz. or 12 oz., would be best to use. Take a little of the whiting out, and put it on one side for future use. Add some vegetable black and celestial

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blue to the large portion of the whiting. Do this very carefully, adding a little at a time, well mixing it, and keep trying the tone of it by putting a little on a piece of white paper or the back of the hand, letting it dry to try the colour, which should be a pale French grey or drab. You must be particular in this, as on it depends whether you get a good photo or not. When you are satisfied, cover your canvas with it, beginning at the top right-hand corner, working to the left, and so on downwards until all is covered, taking care to cross and recross the work with your brush, making sure you do not miss any part; leave this to thoroughly dry. You should now have two or three brushes, such as foliage brushes, and a fitch or two (see Vol. II., No. 92, Figs. 2, 3, 4, and 7). In commencing the painting of the subject after the priming is dry, you must keep the centre very light in tone—that is the part where the person being photographed would stand—gradually gaining in strength of colour as you advance to the outer part of the painting. The best way to execute the centre is to put a little blue and black on a slab or board, take your priming-brush with priming in it, press the ends of the hair into the blue and black, then touch it in the pure white, which you have previously put on one side; lightly punch the brush against the board or a piece of paper—anything clean will do; stipple the whole of the centre, which will give it the appearance of distant foliage. Your own taste and judgment must guide you as to when you have the desired effect. As you work from the centre, the foliage becomes more marked and stronger in tint (see sketch). The front of the scene, showing the grasses, reeds, and leaves of the foreground, should be well defined. As I have said before, there are other colours and subjects innumerable suitable for backgrounds.

For the method of roping a roller I must refer you to Vol. III., No. 154, p. 793, Fig. 9.

MEANS, MODES, AND METHODS.

POINTERS FOR AMATEUR ELECTRICAL EXPERIMENTERS. — In making induction coils, bells, and other electrical apparatus where platinum is to be used — this metal now is very costly — the contact points can be made from the small pins that are in false teeth. There are two pins in each tooth, and old teeth can be procured from a friendly dentist for little or nothing, and it is a good idea to secure some so as to have them when needed.

WATERPROOF CEMENT.—Take 1oz. of gum sandarach and 1 oz. of gum mastic. Dissolve in 1 pint of alcohol; add 1 pint of turpentine and 1 quart of strong vellum glue. Put gums and alcohol on a kettle of boiling water; when dissolved, add the boiling glue. Keep boiling and well stirred till thoroughly mixed, then strain through a cloth. It dries quickly.

PHOTO. DRYER. — A useful contrivance worth knowing, and which is very valuable for drying photographs, is the following :— Get a small (say, 1 in.) piece of watch mainspring, bend double, and heat in a gas flame to prevent snapping; hang this on a line, and put a corner of the print between the ends. This is much better and cheaper than the clips used by most photographers, and does not tear or mark the paper.

MODEL BOILERS: HOW TO FEED THEM.

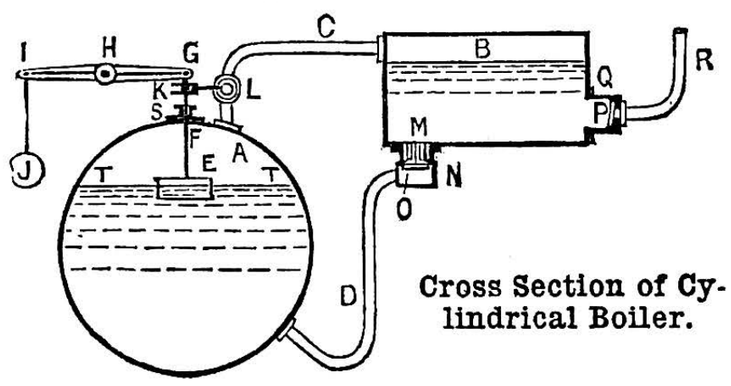
BY FRANCIS CAMPIN, C.E.

THE term "model" is merely comparative, and in this sense I use it in describing a mode of feeding high-pressure boilers illustrated in the accompanying diagram.

Some years since a beautiful little model marine engine to drive paddle-wheels was made by one of Messrs. John Penn & Son's workmen, and fitted into a walnut shell; a short time afterwards I saw at the Crystal Palace a "model" of the engines of the steamship *Simla*. The model was thirty horse-power.

The mode of feeding I am about to describe may be used for any sized boiler, and as it is not patented, it may be adopted without fear of infringement. My remarks are, so far as models are concerned, addressed especially to those who take an interest in them, and who, therefore, do not mind a little dirty work in dealing with metals, and perhaps tedious work in perfecting the apparatus. My practical readers may perhaps look a little farther into the design.

The diagram represents a cross-section of a cylindrical boiler, A, and a feed-tank, B, with the necessary connections. The tank,



Cross Section of Cylindrical Boiler.

B, is placed slightly above the normal water level, T T, in the boiler, A. It is of advantage to place the feed-tank two or three feet above the boiler, to avoid the constant pulsation that would accrue from too slight a difference of levels. Now, the principle of the apparatus is this: So long as the water in the boiler does not fall below its normal level, no communication is open between the boiler and the feed-tank; but communication *may* be open between the feed-tank and an ordinary water-supply through the pipe, R, the only pressure necessary to supply the tank being that necessary to raise the water to the level of the flap-valve, P. I wish this to be clearly understood, that we may have 200 lb. or 300 lb. pressure per square inch in the boiler, A, and only 2 lb. or 3 lb. above the atmosphere in the tank, B. The way in which the water is allowed to flow into the boiler through a system of automatic valves I will now explain.

The tank, B, is steam-tight, and made sufficiently strong to bear the highest pressure in the boiler, A; but it is, of course, very much smaller, as the feed-water may be almost continuously passing through it into the boiler. Water is supplied, under circumstances subsequently described, under ordinary pressure through the pipe, R, and flap-valve, P, into the box, Q, attached to the lower part of the tank, B. The seat of the valve, P, deviates but slightly from the vertical: just enough to allow the valve to seat itself by its own weight in still water. At the end of the feed-tank nearest the boiler is fixed a valve-box, N, from which runs a pipe, D, to the lower part of the boiler, A. Within this valve-box is a stalk-valve, M, opening downwards. Its weight is partly carried by a light spring, O, which holds it near its seating, but will not close it against the pressure of water in the tank, B.

Communication is made between the steam space of the boiler, A, and the top of the tank, B, by a pipe, C, in which is a valve or stop-cock, L. This valve or cock, as the case may be, is operated by a float arrangement.

A lever is fulcrumed to a convenient standard at H, and carries at the end, G, a rod, F, fixed in a float, E, counterbalanced by a weight, J, pivoted to the end, I, of the lever, I H G. The float, E, must be *solid*, to prevent the possibility of its collapse by the pressure to which it is subjected, and therefore it must be counterbalanced to the extent of the difference of its specific gravity from that of water. The rod, F, passes through a lightly packed stuffing-box, S, and carries a pin, K, embraced by the forked end of a lever, which operates the valve, L.

The action of the apparatus is this: When the water in the boiler falls below the normal level, T T, the float, E, descends and operates the cock, L; steam flows through the pipe, C, into the tank, B, and equality of pressure is established in the tank and the boiler. This pressure firmly closes the supply valve, P, and the valve, M, previously closed by the pressure in pipe, D, is released; then water flows by gravity through the pipe, D, until the normal water level is restored in the boiler, and the float, E, raised, whereby the cock, L, is closed, and steam communication cut off from the tank. Then the steam remaining in the tank condenses, the pressure in the pipe, D, firmly closes the valve, M, and a partial vacuum is formed, which facilitates the opening of the valve, P, and the tank is re-filled through the pipe, R.

Now, it may be asked, What is the advantage of this method of feeding? Well, in the first place, it is independent of a steam engine or other motive agent; so is the injector, but the injector must be put into action and regulated by an attendant, whereas this contrivance is automatic, and may, therefore, be used with boilers with which no motive power is connected, and also with those which, being worked by waste furnace gases, do not require the attention of a stoker.

MASRIUM.

AN examination of a mineral which is provisionally termed *masrite* has revealed traces of a substance which differed in several important respects from any known metal, and was therefore recorded as a new one, under the name *masrium*. This word is derived from the ancient name for Egypt, the mineral in which the supposed new element is found being of Egyptian origin. A sample of masrite analysed by the authors contained 10·62 per cent. of alumina, 2·56 per cent. of manganous oxide, 4·23 per cent. of ferrous oxide, with small quantities of ferric and cobalt oxides, and 36·78 per cent. of sulphuric anhydride. The balance was made up of water of crystallisation, the mineral being an impure manganese alum crystallising with twenty-two molecules of water. The quantity of unknown oxide present was 0·2 per cent., and the total amount of mineral being small, the examination of the properties of the element was less complete than is desirable. The properties, as far as they have been determined, are as follows: The metal masrium (formula Ms) falls in the

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second series and twelfth group of the elements when arranged in their periodic order; it has an atomic weight of about 228, and the formula for the oxide is MsO. It gives no precipitate with hydrochloric acid, nor with sulphuretted hydrogen in hydrochloric acid solution, but yields a white precipitate with sulphuretted hydrogen in the presence of acetic acid. It gives a white gelatinous precipitate with ammonia, insoluble in excess, and similar precipitates with ammonium sulphide and carbonate. With potassium ferrocyanide it gives a white precipitate, insoluble in excess of the precipitant, but soluble in excess of masrium chloride. Potassium ferricyanide yields no precipitate. Oxalic acid gives a white precipitate soluble in acetic acid, and in excess of the chloride of the metal. A basic salt is precipitated on boiling a neutral solution of the acetate, but re-dissolves on cooling. Neutral potassium tartrate gives a precipitate soluble in excess of the precipitant, and from this solution ammonia does not precipitate masrium hydrate. The caustic alkalies give white precipitates soluble in excess. The soluble salts are also white, and of those that have been examined the sulphate $MsSO_4 8H_2O$ crystallises best, either from its aqueous solution, or preferably from 50 per cent. alcohol. This appears to form an alum, in which it takes the place of the potassium sulphate in ordinary alum, and also gives a double salt with potassium sulphate. Efforts to prepare the metal itself have been at present unsuccessful, and further information, notably on its spectroscopic character, is necessary before it can be definitely admitted as a new element.

Fig. 1

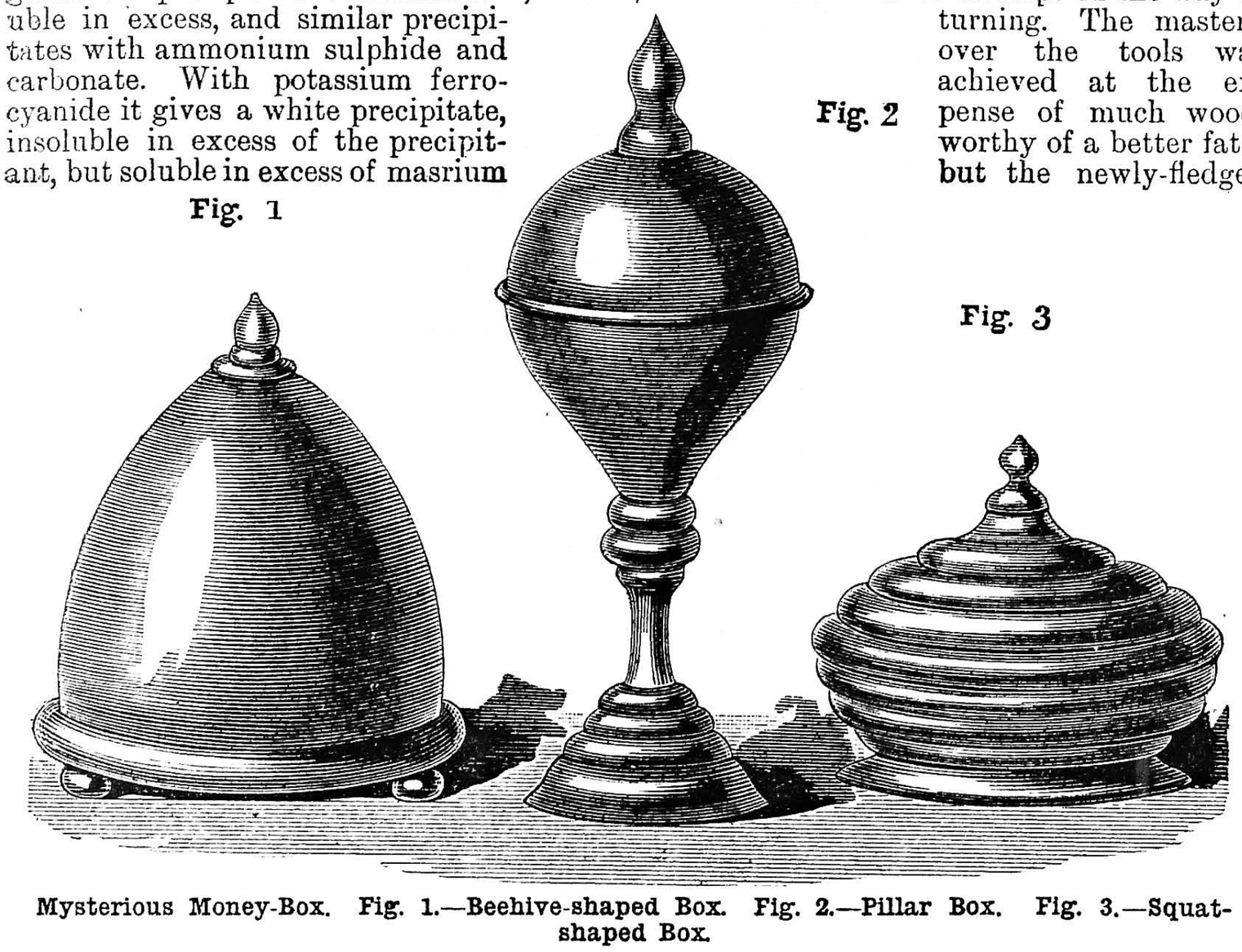

Fig. 2

Fig. 3

Mysterious Money-Box. Fig. 1.—Beehive-shaped Box. Fig. 2.—Pillar Box. Fig. 3.—Squat-shaped Box.

PERHAPS the hardest of all cements is made of 100 parts of white sand to equal parts of litharge and limestone powder mixed with 7 parts by bulk of linseed oil. Under pressure this cement will strike fire from steel.

MYSTERIOUS MONEY-BOX.

BY CAROLUS REX.

THE trifle here described is only worth the attention of such as are novices in the wood-turner's art and mystery. I well remember when, having at length become the happy proprietor of a small lathe, I was at my wits' end to know what to attempt in the way of turning. The mastery over the tools was achieved at the expense of much wood, worthy of a better fate; but the newly-fledged turner's skill seemed to be limited to the production of peg-tops and egg-cups! I should have welcomed such a suggestion as the present, which affords scope for a tolerable degree of manipulative dexterity, yet is easy of attainment. Moreover, the article itself may be considered merely as a hint, all manner of developments being possible.

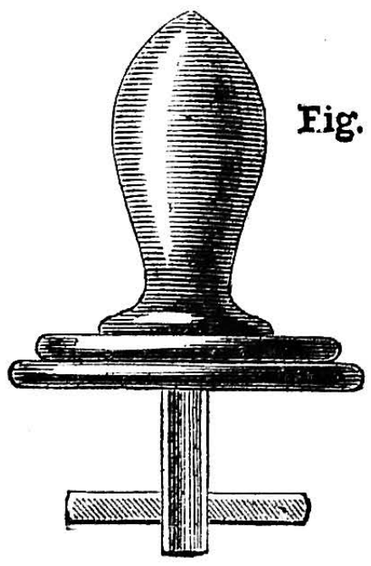

Fig. 4

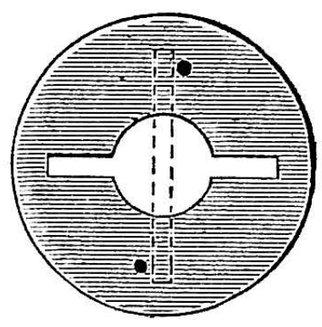

Fig. 5

Mysterious Money-Box. Fig. 4.—Apex and Plug Key. Fig. 5.—Plan of Top.

Fig. 1 above shows an outline very easy to turn, while Figs. 2 and 3 are alternative forms. In the shapes indicated by Figs. 1 and 3 the bottom is in each case turned separately, and is joined by means of screws through the knobs shown; but Fig. 2 is turned in two sections, which are afterwards united at the flange. The puzzle is how the money, which can be heard rattling inside, was introduced into the box; but a glance at Fig. 5, which shows the real top of the box, and at Fig. 4, the actual lid, leaves nothing to be explained. The dotted lines in Fig. 5 show the position of the cross-piece on the peg of the lid when the box is closed; and if the "key" is made to work tightly, the whole will bear considerable handling and minute scrutiny without the secret "leaking out." The black dots on Fig. 5 are to suggest stops, to prevent the entire rotation of the peg. They may be inserted or omitted at the pleasure of the maker. I need scarcely add that to withdraw the money the screws at the bottom must be removed

SCIENCE TO DATE.

Action of Light on Silver Chloride.—Recent experiments by Mr. Baker tend to show that the black substance formed by the action of light on silver chloride is really an oxychloride. For instance, silver chloride exposed to light in air or oxygen gas evolves chlorine and absorbs oxygen. Again, no darkening is produced when the chloride is exposed in a vacuum or under liquids which do not contain oxygen—such as *pure dry* carbon tetrachloride. Further, when darkened silver chloride is boiled with a solution of pure potassium chloride, the whole dissolves, silver chloride being found in the solution together with potash, the production of the latter showing that oxygen is present. When darkened silver chloride is kept in the dark, it turns white again; and Mr. Baker adduces reasons to believe that another oxychloride is formed, a fresh absorption of oxygen taking place.

Properties of dry H_2S.—Mr. Hughes has lately observed the interesting fact that *dry* sulphuretted hydrogen gas has no action on magnesia, baryta, or on salts of silver, copper, mercury, lead, bismuth, cadmium, arsenic, zinc, iron, or cobalt, nor does it in this state redden litmus paper.

Electric Locomotive.—An electric locomotive, which is to be more powerful than any yet made and designed for a speed equal to that of a steam locomotive, is to be built by Messrs. Brown & Boveri, of Baden. It will be provided with motors of 1,500 horse-power.

Liquid Air.—A very remarkable lecture was given lately by Professor Dewar at the Royal Institution, in which a wine-glassful of liquid air was actually prepared in view of the audience. It is a remarkable fact that air is liquefied without change of composition, but the liquid air becomes fractionated by spontaneous evaporation, the nitrogen vaporising faster than the oxygen, and leaving the latter pure.

NOTES FOR WORKERS.

To dilute sulphuric acid (oil of vitriol), always pour the acid very carefully into the water, and never the water into the acid, for in the latter case the acid is liable to spurt on to the operator.

LINSEED OIL is obtained from the seeds of the flax plant. Owing to its tendency to become solid when exposed to the air, it is called a "drying oil"; this tendency is much increased by heating it with about one-twentieth of litharge or one-tenth of black oxide of manganese. The oil thus treated is called "boiled linseed oil."

A NEW porcelain has been obtained by grinding asbestos to a fine powder, dissolving out all soluble matters with hydrochloric acid, making the powder into a paste with water, and baking it in a porcelain furnace for eighteen hours at 1,200°.

PROFESSOR KOCH has not yet succeeded in perfecting his refined tuberculin, and will not supply any to the doctors till he has.

THE French Government think so well of the new type of forts with iron-cased turrets, designed by the Belgian engineers to defend the line of the Meuse, that it has decided to erect one of the same pattern near Lunéville, at Manonvilliers, on the eastern frontier.

THE eight bones of the human cranium or brain case are united by means of irregular saw-like edges, which firmly lock them together and yet allow for their growth.

To stain wood a mahogany colour before polishing, boil logwood chips in water, adding a little soda to bring out the colour, and apply with a brush. When dry, use French polish.

NEW SOUTH WALES, Australia, has a population of 1,132,234, including 14,156 Chinese and 8,280 aborigines. This is an increase of 380,766 since 1881. The population of Sydney is 383,386, being an increase of 158,447 since 1881.

MINERAL lubricating oils have, on the whole, less action on metals than vegetable oils have.

CORK is the bark of a description of oak tree (*Quercus suber*) which grows in great abundance in Spain, Italy, and France.

THE effect of the electric light current on the compasses of some vessels is so great that it becomes necessary to determine how many hours the dynamo has been running before working out the vessel's reckoning.

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"WORK" PRIZE SCHEME.

NOTICE.

"WORK" COMPETITION COUPON

will be found on page 415.

NOTICE TO READERS.

ILLUSTRATED and leading articles in next issue (No. 183) will be :—

DINING-ROOM BUFFET.
WATCH AND CLOCK CLEANING.
WHITENING KEYS OF PIANOS.
HOW TO PUT ON A LOCK.
BORDER ORNAMENT.
CURRICLE HARNESS.
RELEASING POLE STRAPS.
CARPENTRY FOR BOYS—TOOLS.

*** The Editor makes this intimation in the hope that readers, having friends interested in any of these subjects, will bring the same to their notice.

"WORK" PRIZE SCHEME.

"Useful Household Article" Competition.

THIS competition has been an unusually heavy one, and the very large number of suggestions sent in has made the work of adjudication an extremely difficult task. Great care, patience, and much deliberation have been exercised so as to give every competitor the full benefit of his or her suggestion. The result is that the necessity for dividing the prizes has in this instance presented itself, so equal, when considered, as they have been, from all points, do the selected suggestions appear. It would be obviously a disadvantage to the competitors to allot three prizes when six suggestions are adjudged of equal merit, both as regards utility and originality. I have exercised my discretion, therefore, and decided to distribute the prize money in sums of £1 each to the senders of the following suggestions—a course which it is hoped will give satisfaction :—

£1—"Easily Removable Sash" suggestion, bearing the signature "Improvement."
£1—"Improved Bookmarker" suggestion, bearing the signature "Bookmarker."
£1—"Steps Steadier" suggestion, bearing the signature "Aster."
£1—"Hot or Cold Cabinet Bath Frame" suggestion, bearing the signature "Pater."
£1—"Hot Water Dish Cover" suggestion, bearing the signature "Forkless."
£1—"Improved Clothes Horse" suggestion, bearing the signature "Dhobie."

*** The names and addresses will be published when the sealed envelopes are opened and the MSS. printed.

In making this award it should be mentioned that many really good things, which would have taken prizes, were shut out for the reason that the application of the idea was already adopted, or the market contained the same or better things, or the suggestion did not come into the category of a household article. Some of these competitors, however, may look forward to seeing their suggestions put into print as space and opportunity offer.—Ed. WORK.

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*** Advertisements should reach the Office fourteen days in advance of the date of issue.

*** All letters suggesting Articles, Designs, and MS. communications for insertion in this Journal will be welcomed, and should be addressed to the Editor of WORK, CASSELL and COMPANY, Limited, London, E.C.

UNDERGROUND RAILWAY LIGHT.—Why do not the Underground Railway authorities bestir themselves and do something with the electric light both inside the carriages and along the routes which run under and around London? With the progress made during recent years with electricity, it is astonishing that the Metropolitan and District Railway Companies have done nothing to alleviate the misery and mischief which attend travelling along these dark and sulphurous cuttings. Ever since the formation of the underground lines the complaints and clamourings for more light and air have been continuous, and blundering and expensive experiments have, it is true, been attempted to quell the reasonable demands of men and women compelled to travel day and night along these dismal routes. But why do not the authorities turn to electricity, and light these pitch-dark tunnels? They might go further, and tile the walls up to an eye-line. Surely, too, with a little energy in the engineering departments, it would be possible to devise plans by which the miserable lights in first, second, and third-class compartments alike—which are useless for reading purposes—shall be superseded by a light which will permit comfortable reading to relieve the tedium of travelling along these subterraneous passages. We know something of the journey from the "Royal Oak" to Aldgate, and have no hesitation in pronouncing it as ruinous to the eyesight of the thousands who endeavour to read a book or newspaper. Considered in the light of present-day science, it is really disgraceful that the lines remain the dismal and lung-irritating channels they now are. We commend to the directors electricity as a motive power for the engines and an illuminant for the tunnels and carriages. If every season-ticket holder made this matter a condition ere renewing a ticket, the realisation would soon come, and nobody would be the worse. On the contrary, directors and shareholders alike would soon find themselves the recipients of greatly improved dividends.

ELECTRO-MOTORS FOR SMALL WORKSHOPS.—When electric light mains are laid along all the streets of our towns and cities as the gas and water mains are now laid, and the producers of electric power are prepared to supply consumers by day as well as by night with electricity at a reasonable rate, we shall see a rapid development in small electro-motors. Poor dressmakers, now bent double over sewing-machines whilst performing treadmill motion, and wearing out their lives in a ceaseless round of monotonous labour, will then be able to sit or stand, as they please, at machines erected at a suitable elevation, and find pleasure in guiding the work under the swift, regular movements of needles impelled by electro-motors. Ladies will be able to amuse themselves by embroidery with suitable machinery, whilst their servants in the kitchen are grinding the coffee, making mincemeat, cleaning knives and metal-work, and other domestic work, done by machines driven by electro-motors connected by a switch with the electric mains. Shoemakers in their home workshops will be able to stitch uppers and close the boots and shoes at a rapid rate with a minimum of personal labour; jewellers will find pleasure in working polishing-lathes driven by electrical power; dentists will find small motors convenient for driving dental lathes; and hair-brushing by machinery will receive a fresh impetus. Small gas-engines and oil-engines and water-motors will then have to give place to the electro-motor in small printing establishments, butchers' shops, groceries, and bakeries, in working printing presses and in driving sausage-chopping, fruit-cleaning, and mixing machines. But perhaps the most appreciative user of these small motors will be the gentleman amateur engineer or wood-turner, who now owns a small lathe, and finds his pleasure in working wood or metal as a hobby. We can imagine his pleasure in being able to have a clean and cool workshop at all times, unsoiled by the mess inseparable from gas, oil, or steam motors, and free from the din and danger attending these sources of motive power. Then, again, the new era will herald the birth of a new industry—namely, that of small electro-motors suitable to the work. Much has been done in this way already, but much remains to be done; and we may yet live to see establishments rise to cope with the special work of electro-motor making, even as now there are special works for making cycles. Advance, England!

TECHNICAL TEACHERS' PAYMENT.—Some of the County Councils are actually going to guarantee a certain payment to technical teachers. This is as it should be; for, as we have said on previous occasions, the conditions are not such as to tempt a first-class workman to undertake the job of conducting a class, when, at the end of the session, he might find himself out of pocket, his remuneration having depended on the result of the examination. When technical teaching receives its due share of attention, and it is the practice to guarantee payment, then we shall get competent men to come forward. So far, they have not done so. Sir Philip Magnus noted this at a recent meeting at which the Duke of Devonshire presided. No wonder!

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DESIGN AND DECORATION OF ALL AGES.

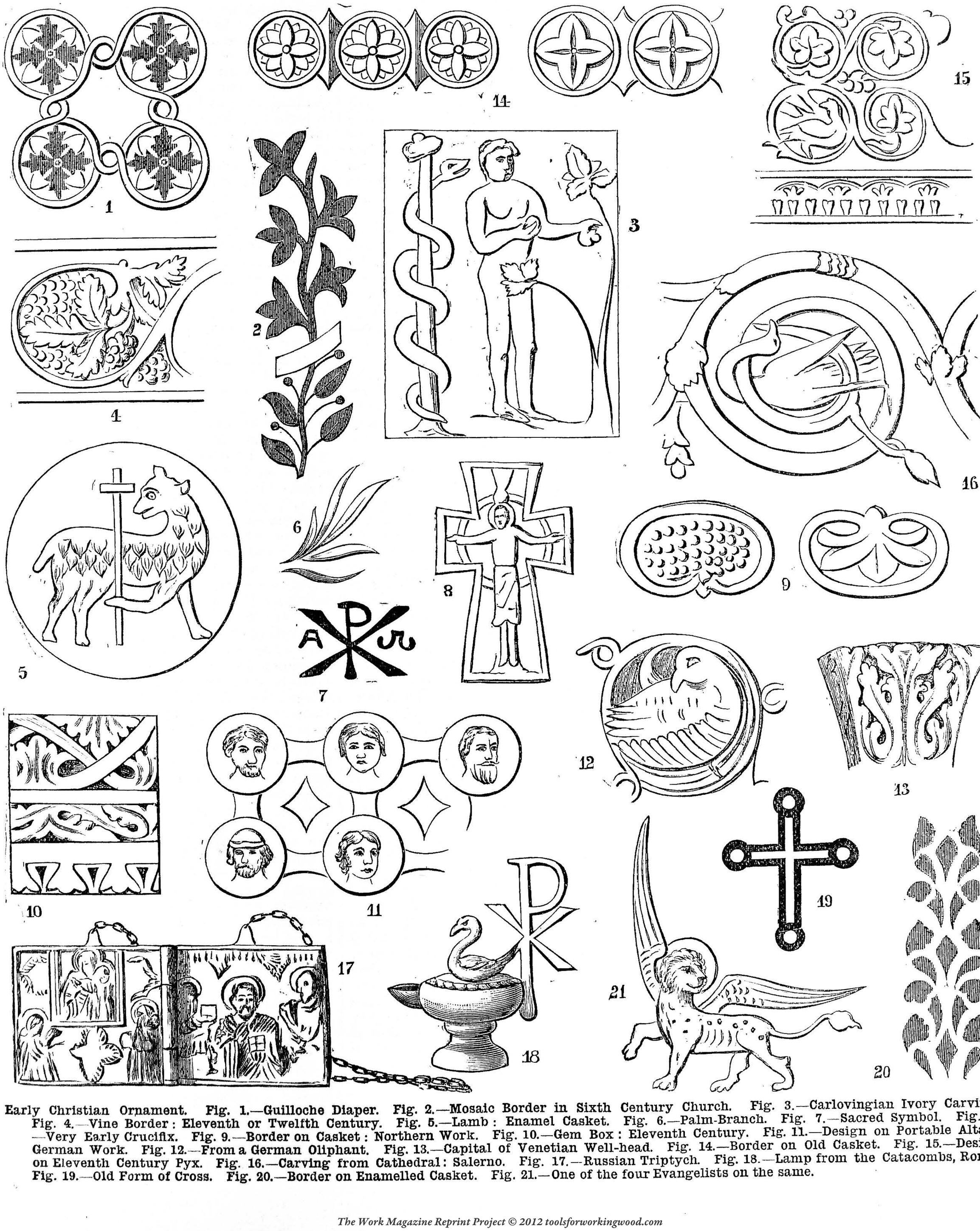
BY M. H. C. L.

Early Christian.

The first specimens of purely Christian art are from the catacombs. These mysterious labyrinths, underlying the great city with their miles and miles of narrow passages, that have never known the light of day, are, to the writer's mind, the most interesting sights in Rome. Here, as we all know, the Christians took refuge, sometimes for months together, from the savage persecutions of the emperors; here their dead still lie buried, row above row. Only parts of the old catacombs have been excavated. Taper in hand, one follows the guides through what seem interminable passages, and constantly on either side is seen, rudely scratched on the rock, a dove, a fish, a palm-branch, showing the dead was a martyr (Fig. 6), whose significance we now know well.

When the sign was drawn, however, it was only to the eyes of the few that it conveyed its sacred meaning, and heathen searchers would pass it by without being any the wiser.

The symbolism of the earliest art of



Early Christian Ornament. Fig. 1.—Guilloche Diaper. Fig. 2.—Mosaic Border in Sixth Century Church. Fig. 3.—Carlovingian Ivory Carving. Fig. 4.—Vine Border: Eleventh or Twelfth Century. Fig. 5.—Lamb: Enamel Casket. Fig. 6.—Palm-Branch. Fig. 7.—Sacred Symbol. Fig. 8.—Very Early Crucifix. Fig. 9.—Border on Casket: Northern Work. Fig. 10.—Gem Box: Eleventh Century. Fig. 11.—Design on Portable Altar: German Work. Fig. 12.—From a German Oliphant. Fig. 13.—Capital of Venetian Well-head. Fig. 14.—Border on Old Casket. Fig. 15.—Design on Eleventh Century Pyx. Fig. 16.—Carving from Cathedral: Salerno. Fig. 17.—Russian Triptych. Fig. 18.—Lamp from the Catacombs, Rome. Fig. 19.—Old Form of Cross. Fig. 20.—Border on Enamelled Casket. Fig. 21.—One of the four Evangelists on the same.

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Christianity has come down to our own days, and in the first centuries after Christ it was a very distinctive mark in all ecclesiastical design. In those times nearly all the art was ecclesiastical, though it was grafted on to the Pagan system of decoration with not the happiest results. It is curious to see in the mosaics of some of the early Roman churches dancing girls and little Cupids and Psyches occupying the circles in the guilloche diaper (Fig. 1), which was a favourite form for the covering of surfaces. In the church of St. Costanza the subject of a mosaic is the culture of the vine. At each corner are vintage scenes: the bringing home the grapes, and treading them out in the wine-press. In the centre is a vine, the branches of which meander over a large space, the grapes being pecked at by birds and beasts and gathered by boys. The whole suggests a fit ornament for a temple of Bacchus; but the artists had, no doubt, in mind the sacred symbolism of the vine, which soon came to represent the Holy Eucharist.

The stiff wreathings of the Romans were adopted by the Christians. In the church of St. Cosmo and St. Damiano (sixth century) there is an apsidal mosaic of Christ surrounded by apostles. Above are some very favourite symbols—a lamb laid on an altar, seven candlesticks, a sealed book, and a roll with seven scenes. The border is a garland with a ribbon twined round. At each turning of the ribbon the flower changes—from a lily to an olive, from an olive to a pomegranate, and so on (Fig. 2).

The Roman churches were built in the form of the pre-Christian basilicas, or halls of justice, with an apse or arched portion at one end, where the altar was placed. It was the vaulted interior of these apses which were decorated with mosaics. Many of these remain intact to this day, and the colours are as fresh and brilliant as ever.

One of the most important of the early Christian churches was that of St. Paolo fuori le Mura, built on the place of St. Paul's martyrdom. It is now destroyed, and a new church stands in its place, built on the old plan, and very beautiful; but portions of the cloisters remain, and are one of the loveliest and most picturesque monuments in the neighbourhood of Rome.

In the age which followed that of the catacombs carvings in stone and ivory became common. The early ones were almost entirely of scripture subjects, very naively treated. In the Lateran and other Roman museums there are sarcophagi cut in stone, with Jonah and the Whale and the like biblical scenes most quaintly depicted, with a multitude of figures crowding each other out of perspective and anatomy.

The Roman Christian art was not confined to Rome. It spread to other Italian cities—notably, Ravenna—which at one period, when Rome itself lay desolate from the hands of invaders, was the capital of Italy. It spread over the South of France and up the Rhine, distinguished in the west of Europe by the general appellation, Romanesque, though developing somewhat differently in the different countries where it took root. Many ivory carvings remain from the Carlovingian age—that is, the period when Charlemagne and his successors ruled over Germany and a considerable part of France.

The Romanesque ivory carvings were generally the outsides of diptychs or triptychs—the former having two leaves and the latter three, with pictures of the saints or other sacred subjects inside. The backs were ornamented since, when, standing upright on a table, as they were intended to do, both back and front were seen.

The heathen Romans borrowed the Christian idea, and secular diptychs were produced with waxen interiors, to be used with a pointed style as writing-tablets.

In the South Kensington Museum, among many other specimens of ivory carvings, is one of these secular diptychs, perhaps a present from some newly-appointed consul to a friend who had helped to gain him his place. It represents a female figure offering at an altar of incense. She stands beside a tree, and a child is in attendance upon her, holding a basket of fruit and flowers. A border of debased "honeysuckle pattern" runs round the picture. The Carlovingian ivories are numerous. Sometimes each leaf contains two or three distinct scenes in the life of our Lord. In this case the scenes are placed one above another, with no dividing line. Adam and Eve were favourite subjects for representation. We have Adam naming the beasts; Adam and Eve mourning on two little hillocks, with three symmetrically arranged trees. The Carlovingian trees seem to have had but two, or, at the outside, three, branches, each with three leaves and two bunches of fruit (Figs. 3 and 4). Caskets were also made in ivory, and tombs of the saints elaborately covered with sacred subjects.

In the middle of the fourth century began a very important development in art—the Byzantine. In 324 A.D. Constantine removed the seat of his empire from Rome to Byzantium, to which he gave the name of Constantinople. He pulled down all the heathen temples and re-built the city; and with its re-building came into existence a new school of art. Many influences combined to produce it—the old heathen tradition of architecture and ornament, the symbolism of Christianity now developed and fixed, the oriental influences which came in through the position of Byzantium as a great trading port with the East, and perhaps a certain inspiration from the immediate neighbourhood of Greece, whence, no doubt, the new artists were largely drawn.

Mr. Stannus finds in the great palace built by Domitian at Spalato, when he retired thither after resigning the empire, the germs of Byzantine architecture. The workmen who built it, unversed in classical tradition, left out the entablature over the abacus, and committed other solecisms, which formed an important new departure.

The Byzantine churches were built on the plan of a Greek cross, with a systematic arrangement of arches and cupolas, surrounded by a dome. The Aya Sophia, built by Justinian—now a mosque—is considered the *chef d'œuvre* of the Byzantine style. A more widely-known specimen of this school of architecture is St. Mark's, at Venice, over which Ruskin goes into rhapsodies.

After the vastness and severe proportions of the Roman basilicas and the impressive grandeur of the Gothic cathedrals of France, Germany, and our own England, the first impression of St. Mark's is apt to be marred by an idea of insignificance; but the more one sees of it the better one learns to know and appreciate the exquisite refinement of its form, the harmonious blendings of its colouring, and the reality of all its decoration, none but the noblest and most lasting materials being used.

Colouring was one of the strong points of Byzantine decoration. From a literal reading of the Second Commandment no images were allowed in the churches of Byzantium—a restriction which still exists in the Greek Church—and the representations of sacred subjects was entirely in painting. As any colours applied to a surface are apt to be fleeting and perishable, mosaic work was soon substituted for painting proper, and the gorgeous Byzantine mosaics—like those of the Roman churches on a gold ground—became famous in the history of art. Costly and beautifully coloured marbles, stones, and gems—cut round, and not with facets—and gold and silver, were lavishly employed in the decoration of the sanctuaries. The mosaics became more resplendent when tesseræ of coloured glass were invented. Wrought metal work was used in the vessels of public worship—the lamps, shrines, chalices, etc.—and the art of enamelling was brought to a high degree of perfection. Of the two kinds of enamel in use respectively in the East and West—the cloisonné, divided by gold wire, and the champ-levé, let into the surface—there is not space to speak here. Both were inventions of this period. The Greek Church has preserved the Byzantine tradition to the present day, and the art which had birth in the fourth century still lives in Russia and modern Greece. Some Russian sacred pictures on a gold ground—crosses, triptychs, etc.—brought from the Crimea by the writer's father, singularly recall the work of the earliest Byzantine days (Fig. 17).

Byzantine art spread widely, especially in some parts of Italy—at Venice, Ravenna, and in other towns. It so affected the whole art of the pre-Gothic period—leaving out, perhaps, that of Rome itself—that the word "Byzantine" is sometimes used for the whole of that era; but a broad line of demarcation may be drawn between the three styles—the Byzantine of Eastern Christendom, the early Romanesque of Western Christendom, with that of actual Rome between. Some writers fuse the terms Byzantine and Romanesque, and treat them as synonymous. Redgrave, in his valuable "Outlines of Historic Ornament," a book which should be in the hands of every student of design, takes the Romanesque as originating in the time of the Crusades; but what appears to the writer the simplest distinction is that given above, the period of Western art before the Crusades being considered the early, and that after it the later Romanesque. The latter will be referred to in the paper on "Gothic Art."

Byzantine as an early Christian art was highly symbolical. Natural forms were also much used. The foliage is stiff, and in the decorations of the capitals is not used as Roman and Greek foliage was—to suggest a springing from the shaft, and supporting the weight above it—but simply as the ornament of a flat surface, which might have been in any position. Fig. 13 is the capital of a column from a well-head at Venice, where the stiff Byzantine foliage is used, though with a tradition of the original idea of leaves so placed. Animals and birds were constantly introduced among the foliage (Figs. 12, 15, and 16), often very quaint in form.

Throughout early Christian art the circle was a favourite form—possibly as an emblem of eternity—either stiff and geometrical, or formed by foliage, and filled in with a head, a figure, or an animal (Figs. 5, 11, 12, 14, etc.). Crosses of all kinds and shapes were, of course, very largely used, and the emblems of the four evangelists (Fig. 21) are of constant recurrence, one often being placed at the end of each arm of a cross, in the shape of Fig. 19.

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The subject of early Christian art cannot be left without reference to the illuminated manuscripts—principally of the four gospels—which came into existence in very early days. The Byzantine manuscripts were of exquisite workmanship, and those of Western Europe developed as early as the fifth century into works of consummate art. The Celtic illuminations will form part of the subject of the next paper. The designs used for illuminating, throughout the rest of Christendom, presented little difference from that used for decoration in its other branches. At first their ornament consisted simply in colouring and beautiful lettering.

SOMETHING NEW IN SINKS.

BY PERCY C. RUSHEN.

I DARESAY everybody has experienced the nuisance of having to dip one's fingers into the dirty water which is standing in a sink,

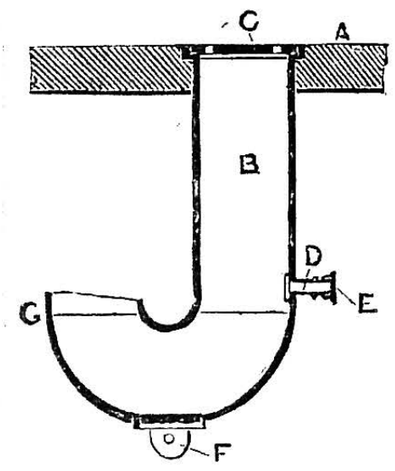

Fig. 1.

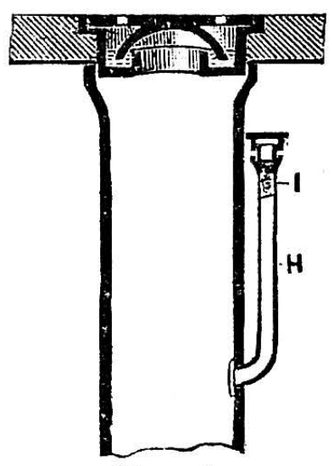

Fig. 2.

Fig. 1.—Device for Air-Screw Pipe. Fig. 2.—Alternative Method.

in order to lift the trap to allow the water to descend into the drain. Without this, it will never go down if it does not descend at once. Very few people, except those experienced, know what it is that causes this. The reason for it is that the water, suddenly covering over the holes, imprisons the air in the tube, and unless the weight of water presented at the holes is sufficient to expel the air, the water will not descend. In some cases the air comes up through the water in bubbles. Of course, the more the holes are choked up the less weight of water is presented, and for this reason many people think it is this alone that causes the water to stand.

To remedy this, a small pipe with a screw cap may be soldered in it. This is only suitable for pipes which are trapped below the lid, as they are often done now, and having a screw cap to clean the trap. Fig. 1 represents this device, where A is the sink, B the pipe, C the lid of the pipe perforated with holes, D the small air pipe, and E its screw cap; F is the screw cap to withdraw to clean the trap, and G is the water level in the trap. When the cap E is unscrewed, it allows the air to escape. The air cannot be foul, and if the water is found to come out of the pipe D before the cap E can be screwed on the pipe may ascend a little.

In Fig. 2 is represented a device for pipes in which the portion at the lid is trapped. The air pipe is the same, except that a piece of sponge is preferably placed before the cap, as the air in this pipe is foul, and the cap must be kept on when not wanted to be removed; H is the air pipe, and I is the sponge. If required, the pipe could be continued to the outside, and in this case a cap would not be needed; or if a stop be wanted, a seated spring valve could be placed in the middle of the pipe. Or, doubtless, if it were carried up to the lid descending again, and if the valve were placed as low down as possible, the sudden expansion of the air caused by the opening of the valve would be sufficient to enable the water to descend.

Of course, many modifications will occur, but the foregoing will be very good examples.

SOME GOOD THINGS.

Gold Paint.—We have recently had an opportunity of testing the properties of Pavitt's Ardenbrite Liquid Gold, an advertisement of which frequently appears in our columns. With the sample before us, and the experiments we have tried with it, we have no hesitation in pronouncing it a really good thing, answering all the points the maker claims for it. We have tried it upon deal, oak, and white enamel, and find it answers as well almost as the ordinary process of leaf gilding. With the experience before us of having to get some old English picture-frames regilded—a process which, when too late, we discovered to be more costly than the buying of new frames—we shall in future stand independent of the frame-maker and try Ardenbrite Liquid Gold instead. For this purpose, and all others where gilt can be applied in or out of the household, Ardenbrite can be thoroughly relied upon.

Harness.—We have pleasure in calling our harness-making readers' attention to a straight-pull and easy releasing buckle introduced by Smith & Co. This ingenious buckle for harness has the merit of a tongue, apart from the buckle-frame, standing upright at right angles to the strap, so that the pull on the hole in the leather is never oblique as with the common buckles, which tends to tear the leather at the hole, shown by Fig. 1. The buckle-frame has a middle-bar and a heel-bar, each with a distinct purpose; the heel-bar is for the frame to turn upon, the middle-bar serves as a lift to the strap, raising it off the tongue in the act of lifting, as shown by Fig. 2. The easy release of a strap from such a buckle is an advantage to horses who have been thrown down by the greasy asphalt roads. This meets a want such roadways create. Fig. 3 shows the buckle of a trace with a straight, level pull. Its neatness is obvious, and it deserves a trial of all well-wishers of the horse.

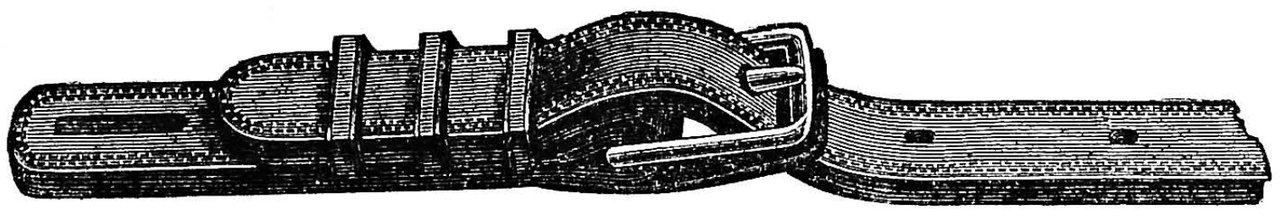

Fig. 1.—Old Style, showing Bent Pull.

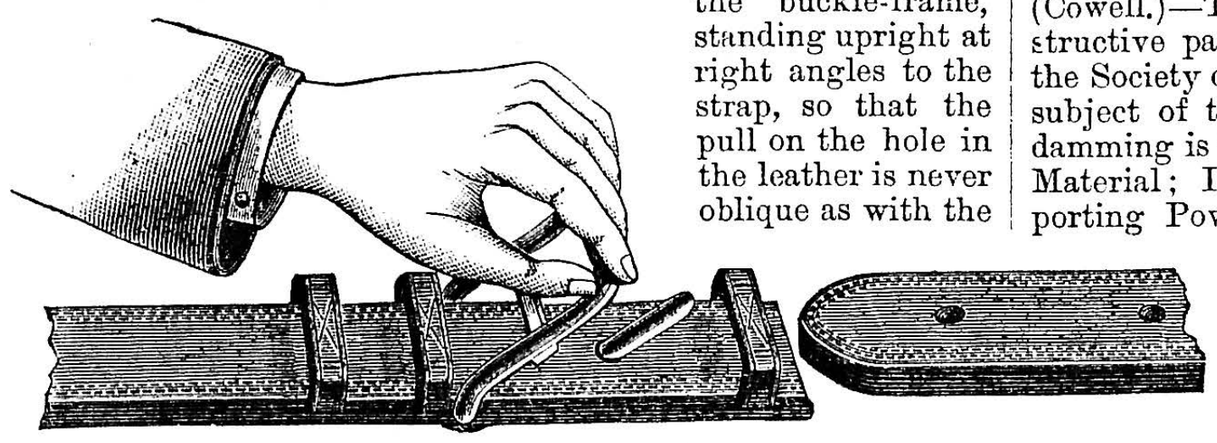

Fig. 2.—New Style, showing Releasing Arrangement.

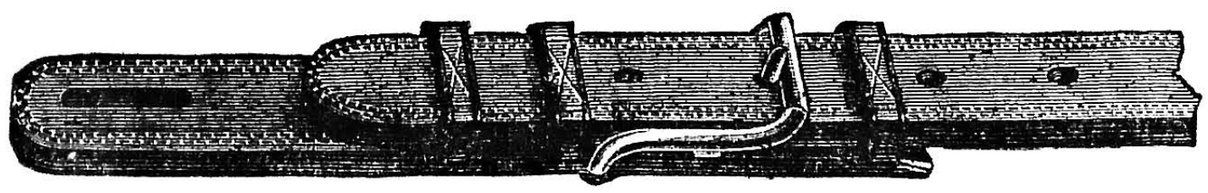

Fig. 3.—New Style, showing Straight Pull.

BOOKS.

Electricity.—"A Guide to Electric Lighting." S. R. Bottone. (Whittaker & Co.)—Now that electric lighting is asserting its supremacy over gas, it is reasonable and right that everyone concerned should know something of the new illuminant—one which must before many years be with us in our every apartment. With this view, the handy guide now before us will supply a real want. Designed for the use of householders and amateurs, the merest tyro will be able to acquaint himself with the essential features of electric lighting, whether on a large or small scale. It is taken for granted that the reader knows nothing about the subject: hence everything touched upon is explained sufficiently to enable him to form an intelligent idea of the results indicated.

Chip Carving.—"Hints on Chip Carving." Eleanor Rowe, with a Preface by T. R. Ablett. (Sutton Drowley & Co.)—This little manual, issued with the sanction of the Science and Art Department of the Committee of Council on Education, will be found very serviceable to the thousands who take interest in wood carving. Miss Rowe, the Manager of the School of Art Wood Carving, is so pre-eminently fitted to speak upon the subject, that a wide field is sure to be found for the present manual. The preliminary chapters are simple and interesting, leading on to some very pleasant and beautiful work in Icelandic, Swedish, and Norwegian carving.

Photography.—"Photography Annual for 1892." Henry Sturmey. (Iliffe & Son.)—This compendium of information and statistics of the year relating to photography, now in its second issue, has developed wondrously on its first issue. Its object is to bring the subject of which it treats absolutely up to date, and this we have no hesitation in saying it does thoroughly well. So vast an amount of valuable information is pressed into its 900 pages, that we shall predict for it as phenomenal a success as attended the issue of its predecessor.

Timber.—"Timber Piling, in Foundations and other Works," by Henry Adams, M.Inst.C.E. (Cowell.)—This is a very interesting and instructive paper, read by Professor Adams before the Society of Architects, in which the important subject of timber piling in bridge making and damming is treated under the following heads:—Material; Its Preparation; Pile-driving; Supporting Power of Piles; Examples of the Use of Piling. Attached to the pamphlet is a well-executed sheet of really valuable diagrams bearing upon the subject of timber piling.

Inventions.—"Practical Guide for Inventors." E. Eaton, C.E., M.S.A.—This is a fourth edition of a useful handbook issued by Mr. Eaton detailing much valuable information connected with the subject of patents. Every year the field of patents, designs, trade marks, and the like, is becoming more and more extended; and the general public, and inventors and patentees in particular, cannot become too familiar with the details involved in protecting a good idea should it occur to them. A good deal of discussion has already gone on in the pages of WORK, valuable alike to inventors and patent agents. We have much pleasure, therefore, in noticing Mr. Eaton's publication.

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TRADE: PRESENT AND FUTURE.

*** *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

MARINE ENGINEERING TRADE.—No change in the Mersey shipbuilding trade is reported, but the Barrow district marine engineers are fairly busy, as are also the shipbuilders.

RAILWAY MATERIAL TRADE.—Manufacturers of railway material are booking orders.

CHEMICAL TRADE.—The chemical market is steady, prices being unchanged. Bleaching powder is reported as scarce.

BUILDING TRADES.—In Durham county trade is still brisk, and, as a rule, the relations between masters and men are friendly. Building operations in Newcastle and district are vigorous.

CUTLERY TRADE.—One or two firms have been fortunate to book special lines. Orders from Australasia are very scarce. The Rodgers' strike continues, the firm not being inconvenienced, while the men are receiving support which will enable them to fight for some time to come.

GLASS BOTTLE TRADE.—This trade is cramped, owing to the limited number of orders and the overstocked condition of the market. The largest glass bottle makers in St. Helen's have served notices upon seventy of their workpeople. Several operatives in this trade, trying America, have been literally boycotted there, and cannot find work.

SILVER TRADE.—Improvement is noted in the Sheffield silver and electro-plated trades. Good orders have been booked for first-class table silver.

FIRE-BRICK TRADE.—There is a fair demand for fire-bricks. Some makers report heavy exports. Prices unchanged.

TIMBER TRADE.—This is steady; imports large.

ARMOUR-PLATES TRADE.—The armour-plate houses are well employed. The distribution of a few good Government orders for armour-plates to Sheffield would have a beneficial effect, as, with the heavy trades doing well, the minor trades prosper.

TAILORING TRADE.—Our Liverpool correspondent writes:—The lock-out of the tailors is in full swing. The official statement of the operatives gave forty-five as the number locked out of five shops, and there are seven hundred and fifty men working in fifty shops where no workpeople are locked out.

COTTON TRADE.—It is doubtful whether employers will be obtained to enforce a 5 per cent. reduction of wages in the spinning section of the Lancashire cotton trade. If 10 per cent. reduction cannot be obtained, 5 per cent. is not worth contending for. Meantime, the depressed condition of the trade is becoming intensified; the stock of yarn is increasing, and machinery is stopping.

ENGINEERING TRADE.—Rather more activity prevails in the engineering trade of the Lancashire district. Some of the leading machine tool makers are busy, and the large stationary engine builders have also a moderate amount of work. Boiler makers report work coming forward. Locomotive builders have very little work on hand, and the prospects in this branch are disheartening. Railway carriage and waggon builders are also slack.

COAL TRADE.—At Newcastle best steam and gas coals are steady; household and bunker coals dull; best Northumberland steam, 10s. 6d. per ton f.o.b.; best Durham gas, 8s. 6d. to 9s.; bunkers, 7s. 6d. to 10s. for best Durham screened. Coke, steady from 15s. to 17s. per ton. At Sheffield the demand for house coal is limited. Locomotive sorts and coal for shipping are selling well. Coke is not easy to place, but engine slack is selling moderately. Prices per ton: best Haigh main, 13s.; seconds, 12s.; Silkstone hards, 12s.; house coal and coke, 11s. 6d.; Stanley main seconds, 9s.; steam coal, 9s.; coke, 8s. 6d.; slack, 6s. to 7s.; smudge, 3s. 6d. to 6s.

IRON TRADE.—Very slow business is being done in the Lancashire iron trade. Manufactured iron shows no improvement. The steel trade is practically unchanged, but prices for raw material fluctuate considerably. Our Sheffield correspondent writes:—The dulness continues, and the firm tone of the pig-iron market appears to be giving way. In the Middlesbro' iron trade the demand for pig iron is in excess of the supply.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** ***In consequence of the great pressure upon the "Shop" columns of WORK, contributors are requested to be brief and concise in all future questions and replies.***

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.

I.—LETTERS FROM CORRESPONDENTS.

Trousers Cutting.—AMATEUR TAILOR writes:—"I cut my own trousers from my own cloth as follows: For my requirements I cut a paper pattern to the size suggested by the figures. First draw the line A B, with a straightedge near the edge of the paper, about 45 in. long; then square over the line C D, the size of the waist being 37½ in. We take one quarter of that, 9⅜ in., add ½ in. for the waist, and ½ in. for the two seams at C and D. This makes a total of 10⅞ in. Mark off that distance at C; then draw the line C E parallel to A B; at E, 14 in. down, square out a line to F. This projection is called the crutch, and is governed by the waist measure, 37½ in. Take one-twelfth of this—that would be 3⅛ in.—mark it off at F, adding ¼ in. for seam, and draw the curve joining the line about 9 in. down from the waist; then measure down 33 in., the length of the leg seam, and add 1 in. for turning up at the bottom. Halfway down at the knee, measure over from the long line 9⅛ in., add the two quarters for seam, then join the line at F by a gentle curve, and so on. I don't profess to teach, but simply want to show that it is a simple enough job, involving only a sort of free-hand geometry, with variation to suit different shaped figures. Trouser patterns are laid on as shown in the diagram. Black-faced cloths must be cut with the nap running downward only. A great deal of information concerning tailoring appliances, books on cutting, etc., is to be seen in one of Messrs. Platt's catalogues, St. Martin's Lane, London, W.C. In cutting, no expensive tools are required by the amateur. A straightedge, a square, a 2 ft. rule, if you have not a measuring tape, a pair of sharp scissors, if you have not a pair of shears, and a piece of pipe-clay, are all that is necessary. The following are the measures (in this instance my own) which would have to be taken: Waist, 37½ in.; hips, 45½ in.; leg, 33 in.; side seam, 45½ in.; thigh, 26 in.; knee, 19 in.; bottom, 19 in. The diagrams show how to lay the patterns on the cloth, so as to make the best of it."

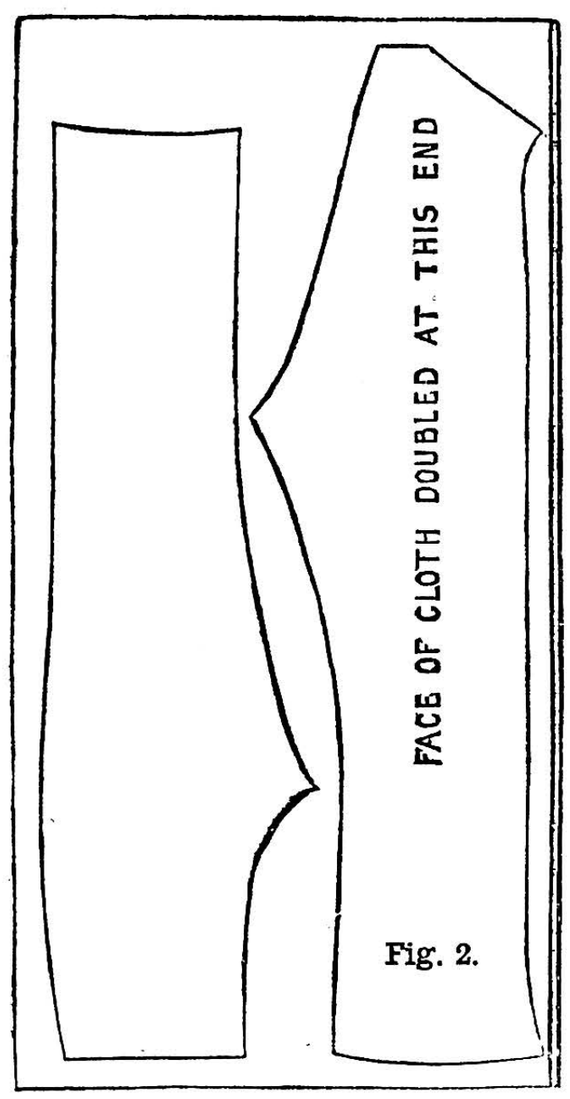

Fig. 2.

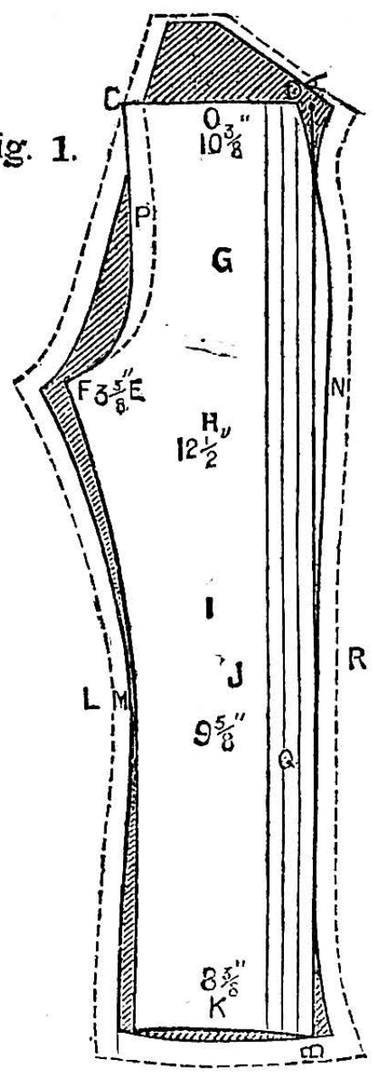

Fig. 1.

Trousers Cutting. Fig. 1.—Trousers Pattern—G, Hip; H, Thigh; I, Fore Part; J, Knee; K, Bottom; L, Leg; M, Inlay; N, Inlay; O, Waist; P, Fly; Q, Strips; R, Side Seams. Fig. 2.—Showing Trousers Pattern on Cloth.

Mail Cart.—W. H. M. (*Grimsby*) writes:—"I have observed the design in No. 174 (see page 284), and think it a very nice one; but I consider there is one serious drawback to it: no protection against tipping backward is provided."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Cement for Carbon Plates.—T. H. (*Dublin*).—The cement employed with fine carbon dust in making carbon plates is a strong syrup of sugar or treacle. The pasty mass is pressed into an iron mould and baked. The resulting cake is again dipped in syrup, returned to the mould, and again baked at a white heat. It does not pay an amateur to make carbon plates in this way. In making them from gas retort scurf by sawing the scurf, do not attempt to cut them smooth. A rough, irregular surface is an advantage rather than otherwise.—G. E. B.

Sash Making.—F. W. H. (*Aylesbury*).—Articles appeared in WORK, Nos. 147 and 153.

American Organ.—E. B. (*Manchester*).—These articles are in hand.

WORK—Back Numbers.—H. H. (*Coleford*).—Messrs. Cassell & Company, London, E.C., can supply most of these. Those which are out of print you would get, probably, by advertising in WORK. A carpenter's bench was treated in No. 180.

Wall Mirror.—S. P. (*Nottingham*).—I am not acquainted with any firm who would make the articles; and in designing the mirror, I thought there would be little trouble in getting something to suit at any good brass furnisher's, and still think so, if the inquirer will write one of the many large firms in that line.—R. C.

Sign-Writing.—F. C. C. (*Manchester*).—Articles on Sign-Writing appeared in WORK, Nos. 1, 2, 4, 11, 13, 17, 19, 23, 30, 34, 39, 43, 44, 45, 47, 49, and 51; on Painting and Decorating, in Nos. 27, 29, 35, 36, 42, 43, 44, 46, 47, 50, and 52; on How to Paper a Room, in No. 161.

New Fireplace.—P. G. A. (*Liscard*).—This can be obtained of the Teale Fireplace Co., Leeds.

Quarter-Horse-Power Steam Engine.—D. D. (*Leven*).—Articles appeared in WORK, Nos. 106, 110, 121, 125, 131, 136, 141, 145, and 149.

Bell Indicator.—DAILY READER OF "WORK."—You should have no difficulty in getting a glass for your indicator. It is simply a piece of glass made to fit the frame of your indicator, blackened on the inside, with little round spaces left clear. There are no holes in it. If you have made your indicator yourself, you are quite capable of accomplishing this part of the work, which to me appears to be the easiest part. Get your glass, and where you want the spaces to appear paste round pieces of paper, and after having cleaned the glass, varnish over with "Castle Brand" black lacquer. Give two or three coats, and when all is dry the paper circles will peel off easily. If you do not succeed, and must buy your glass, write to Messrs. Gent & Co., Faraday Works, Leicester.—W. D.

Work Table.—R. N. (*Glasgow*).—Rather than dive haphazard among probabilities, I prefer to ask you a question or two. There is more than one table with a lift-up top, but as you are about to use turned legs in connection with your prospective article, I assume that what you want is the oblong job which has a double-hinged top, which revolves and opens book fashion, exposing draught and backgammon boards, and having a draw-out well for loose work. Is this so? If so, please state or sketch, as well as you can, particulars of the appearance of the article you need information of.—J. S.

Zither Teacher.—"IN REQUEST."—You might have ascertained this long ago by making inquiry at the various music warehouses in your district. I am unable to mention anyone resident in your locality. Write and ask Herr Goebël, of Museum Street, W., who will, no doubt, be in a position to tell you whether there is or is not a teacher in your vicinity.—A. O. T.

Library Chair.—J. W. P. (*Holborn, W.C.*).—I do not know of a firm that sells chairs exactly of the section shown in Fig. 2, page 98, but I daresay by looking up a few dealers you will find the thing you require. As a general rule, in those which are burdened by superfluous ornament very little attention is paid to provide a comfortable back and seat; and you will sooner discover a good outline in a plain chair than in an elaborate one.—F. J.

Barometer.—T. H. W. (*Liverpool*) has purchased a barometer from a dealer, who warranted it in working order; but when hung on the wall it stuck at "Set Fair." On an examination, he finds the mercury is divided; portions filling the extreme ends of the tube, with an empty space between. Shaking, tapping, etc., fail to bring the broken column of mercury into conjunction, and he now asks what to do. It is clear if the instrument was bought under a warranty, then the only course is to return it to the dealer and let him set it right; but I presume there will be some flaw discovered by the dealer in the form of warranty by which he will creep out of the responsibility. The present condition of the instrument will arise, I think, from one of two causes—first, in carrying it home he was not careful to hold it perpendicularly, and so a portion of the mercury was allowed to run to the other end of the column, and a bubble of air has got between the two portions, and so prevents an union; or else the

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mercury has become very impure, and when at its greatest expansion the upper portion has stuck to the tube, and the other portion has contracted and left the space between. If the former is the cause, then I should carefully heat the lower portion so as to expand the mercury, gently tapping the tube the meanwhile, so as to dislodge the air. Care must be taken not to make the tube very hot, especially at the bend, lest it should break. T. H. W. will find it a somewhat troublesome job, but with care and patience it will yield, I think. On the other hand, if the mercury has stuck through impurity, then the only thing to do is to empty the tube, and either distil the mercury and re-fill, or, what is simpler, press it through a piece of clean chamois skin; this will permit the mercury to pass, but will retain the dross. When the mercury is made pure, the tube must be filled as at the first. Pour a small quantity through the open end, and let it fall as far as it will in the other limb; a cushion of air will prevent it falling to the bottom. Heat must now be applied, which will force bubbles of air past the mercury. When a portion has reached the bottom, then another portion must be introduced in the same way. Bubbles of air must be looked for between the mercury and side of tube—a hand-glass will be necessary; if any are visible, they must be expelled by heat, as before. If now the mercury sticks to the glass, it means that moisture has been introduced into the tube by some means; this too, like the air, must be expelled by heat. If T. H. W. will carefully attend to these directions, I think he will find his instrument answer all right. If, in emptying the tube, particles of impure mercury adhere to the inside of the tube, they must be removed by nitric acid, after which the tube must be carefully washed and dried before introducing the mercury.—O. B.

Gas Meters.—E. F. B. (*Darlington*).—It is absolutely imperative for all gas meters to be stamped with the Government stamp, and any testing must be done by the Government inspector. The general method adopted, if there is anything wrong with the meter, is to adjust the rate of payment by a reference to the account for the corresponding quarter of the past year. If the gas company have broken the Government stamp, and have failed to have another one put on by the proper authorities, they are certainly guilty of fraud, if the facts are as you state. But I should advise you to buy the "Act for Regulating Measures used in Sales of Gas," published by Eyre & Spottiswoode, Queen's Printers, London, price 6d.—E. D.

Camera.—PHOTO.—In WORK, Vol. I., No. 23, you will find full instructions for all required to make a good camera. There are a great number of elementary works published. "Beeton's Modern Photography" or "The A. B. C. of Photography," by the Stereoscopic Company, would probably suit you.

Reckoning Sizes of Pulleys.—HULL.—You forgot to mark with an X the pulley you wished the size of; but I can help you best by explaining how you can yourself find the sizes. Begin with the 200 revolutions of the engine, and suppose you wish the line-shaft (main-shaft) to run 300 revolutions; then if pulley on engine is 12 in., multiply 12 by 200 and divide the result by 300, thus $\frac{12 \times 200}{300} = 8$; therefore the pulley driven by the engine pulley must be 8 in. in diameter. Now you want to run the saw at 900, and its pulley is 6 in, which is driven by the line-shaft running at 300—that is, you want it to run three times as fast; then, since 3 times 6 is 18, you must have an 18 in. pulley on the line-shaft to drive the 6 in. pulley of the saw. Now as to the lathe, why do you want it to make 2,000 revolutions? I should not like that even for the smallest work; 900 or 1,000 are surely quite enough for the fastest speed. Suppose you are content with 900, then have the countershaft run the same rate as the line-shaft strap running on equal wheels, and have the largest step on the countershaft pulley 9 in. and the smallest on the lathe mandrel 3 in.—that will give you 3 to 1 again, and make the 300 revolutions of the countershaft into 900; also the slowest speed will be from 3 in. pulley on countershaft to 9 in. on mandrel, or 1 to 3, which will make your slowest speed for turning 100 revolutions.—F. A. M.

Chain Gear Cycles.—DOUBLE GEAR.—There are several change gears for safeties already in use. Of course, I am not prepared to say whether any of them are exactly like your correspondent's idea. The latest two-speed gear is that of the Cycle Gear Co., Coventry. I have not yet seen it, so cannot describe it. To get reliable guidance in the matter, write to Mr. R. E. Phillips, Consulting Engineer and Patent Agent, Royal Court Chambers, 70 and 72, Chancery Lane, W.C. He will supply copies of patents relating to double-chain gears at a very small cost.—A. S. P.

French Polishing and Stains—Book.—GUMPOT.—Why do you want to buy books when you have all you may require at your fingers' ends in the pages of WORK? Vol. III. contains a series of articles on the subject, and the replies in "Shop" deal with points and difficulties such as you and amateurs generally may meet with, and which it would be impossible to foresee and embody in any book on the subject. There is no book on the subject of staining to our knowledge; there is generally a chapter devoted to the subject in works on French polishing. It shall, with the Editor's permission, receive due attention in time in the pages of WORK. Meantime, fall back on H. C. Stephens's stains, which can be bought ready made either in liquid or powder—they are used in many cabinet shops in preference to making their own by reason of their uniformity of colour and depth of tone—that is, if you can find none in "Shop" to suit.—LIFEBOAT.

Incubator.—W. H. S. B. (*Derby*).—Order from your bookseller Nos. 143, 150, and 151 of WORK, or send 4½d. in stamps to publishers for same, and you will find full instructions on this subject.—LEGHORN.

Tool for Boring Pulleys, etc.—J. A. (*Middleton*).—Fig. 1 is a sketch of an ordinary chucking-drill as used for boring cast iron; it usually has no point, since it is used for *enlarging* holes which have been bored or cored. Fig 2 shows the process—B is the pulley boss, A the drill, C the back-centre, R the boring-rest, which both steadies and prevents

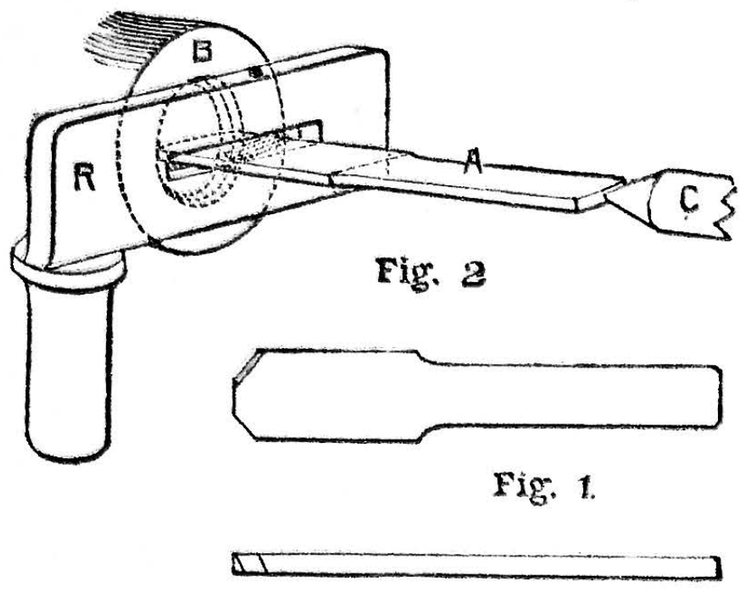

Fig. 2

Fig. 1.

Fig. 1.—Chucking-Drill. Fig. 2.—Tool in Process of Boring.

the drill from turning. The hole is started with a slide-rest tool so as to get a true entry, and in Fig. 2 the drill is supposed to be just beginning its work. I don't know of an expanding mandrel not patented, but you should have a set of solid mandrels rising by eighths. It is best to have them of hardened steel and ground true.—F. A. M.

Viola.—F. H. (*West Ham*).—Before attempting to make a "viola," which is a "tenor" violin, why not try your hand at making an ordinary violin? You have full directions, patterns, and dimensions given in the back numbers of WORK. The instructions for making a viola would, to a great extent, be a repetition of those you possess, the outline and the various dimensions only being different; the method of making both instruments is exactly the same. To give a full outline and patterns would occupy too much space for "Shop." Here are the measurements you ask for: Length of back (exclusive of "tab" or "button"), 16¼ in.; width of upper bouts, 7¼ in.; width of lower bouts, 9½ in.; width of waist, 5¼ in.; depth of ribs, 1½ in. at the top, deepening to 1 5/8 in. at the bottom; length of bass bar, 12 in.—B.

Kitchen Dresser.—J. G. (*Edinburgh*).—You will find most of your questions answered in Vol. III., p. 530, but perhaps this arrangement (see sketch)

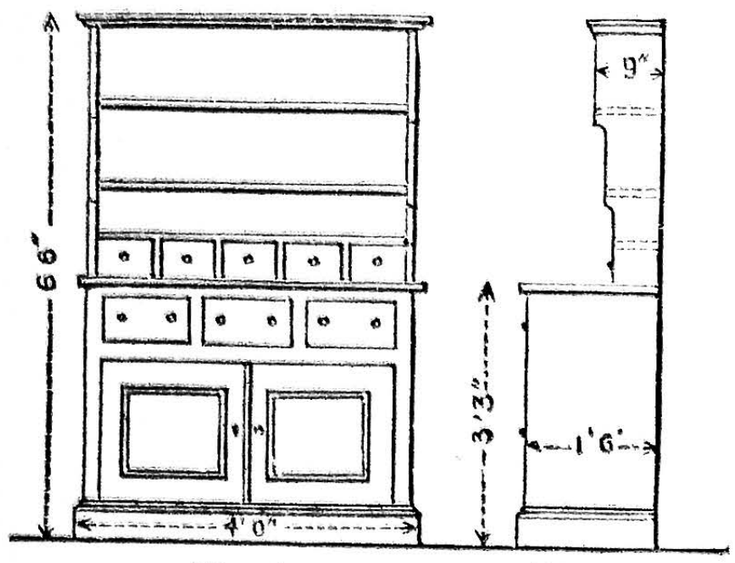

Fig. 1. Fig. 2.

Kitchen Dresser. Fig. 1.—Elevation. Fig. 2.—Section.

would suit you better, and the sizes marked thereon will be more convenient than those given in the design referred to above.—F. J.

Greenhouses.—H. F. (*New Cross*).—Several designs have been given in the present volume (IV.) of WORK. Consult previous indexes and "Shop."

Poker Work Machine.—M. T. (*No Address*).—I am sorry to say that you have evidently made a mistake with regard to the machine for poker work at that low price. The cheapest apparatus I have ever come across was one of German make, the price of which was 10s. 6d. I am sure it could be obtained of Derry & Tims, Kensington High Street, W.; or try one of Messrs. Hallam & Scott's, Manchester. A machine at the price you mention could not be made strong enough for the purpose. It is necessary to use the best materials, otherwise there might be an explosion of the benzoline, and the work would turn out to be rather dangerous.—J. N.

Incubator.—F. C. B. (*Deptford*).—Your ether is too strong, or else you are using too much of it. Half an inch above the mercury is ample. The proportion you are using is correct, but possibly your drops are not all the same size. If the ether forces past the mercury it is evidently too strong, and must be weakened. You will then find the mercury resume its normal position.—LEGHORN.

Electro-Silver-Plating.—F. C. (*Plymouth*).—(1) Your silver-plating solution is not the best obtainable. When silver is precipitated from its nitrate solution by adding a solution of carbonate of potash, and this precipitate is dissolved in cyanide of potassium, there is an excess of potash in solution, which does no good then, and eventually does harm. The silver should be thrown down as silver cyanide by adding a solution of cyanide of potassium to the nitrate solution; then dissolve this in a solution of potassium cyanide to form the plating bath. (2) The Daniell battery with 6 in. porous cells is all right. Your failure in successfully plating the cruet-stand is due to more than one cause. First cause: The frame, having lead mounts, or so called "silver edges," is composed of two kinds of metal, which form a galvanic pair in the solution, and the lead dissolves under the influence of the current. Consequently, it will not receive an adherent coat of silver. Second cause: The silver remaining on the unworn parts increased this local action in the plating solution. Third cause: The anode surface was just one-fourth too small, and the quantity of solution also too small for the job. The solution was not strong enough at first, and was weakened by trying to plate such a large article. (3) The lead mounts, together with the whole frame, *must* have all the old silver stripped off in an acid pickle. The whole frame *must* then be coppered in an *alkaline* coppering solution before it is placed in the plating solution. A sulphate of copper, or any other acid, solution will not do. The process is too long to be detailed here in "Shop," but is fully described in my "Electro-platers' Handbook." (4) Some information on silvering jewellery has been given in WORK, Vol. III., p. 118. From this you may learn something. My "Electro-platers' Handbook" is a book of moderate price (the price is 3s.), and you can get it by ordering it of any bookseller. I do not know of any other at such a low price.—G. E. B.

Scene Painting.—R. B. S. (*London, N.W.*).—You may, if proficient, obtain employment by reading the "Wanted" columns of the *Era* theatrical paper, which appears every Saturday, and generally has one or more advertisements for assistant scenic artist. Go for a small salary first, to get a start, which is *most difficult*; but get it, and if you have any talent at all, you will soon rise. If I knew your abilities, I could tell what chance you had of success. One piece of advice I would give. Do not go too far away from home, as money is not always sure. In theatrical terms, "the ghost may not walk," and you would be in difficulties. You, having no references, must state that you have been very successful as an amateur, and accept any terms to get your first start. I wish you every success.—W. C.

Organ-Building Book.—W. W. (*Camberwell*).—Apply to Messrs. Crosby Lockwood & Co., Stationers' Hall Court, Ludgate Hill, London, E.C.

Brazing Tube.—T. W. S. (*Deptford*).—Presuming that you have a forge, or the use of one, to braze your stamping to a tube, proceed as follows: Carefully file out and clean the inside of the tube where the stamping is to fit; then fit your stamping to it. Let it fit very tightly. As to pinning it, I do not consider it necessary; if it is brazed well, the pin is a superfluity, and if it is brazed badly, the pin will not be of much use. Make up a clear fire of coke (broken small), and wind some small brass wire round and round the part to be brazed. Have by you some powdered borax and some spelter in some such receptacle as the lid of an old canister. Sprinkle a little borax over the spelter, and moisten it with water. Flatten out a piece of ¼ in. rod at one end, and turn an eye at the other; this will do for putting on the spelter. Place the work on the fire when quite clear, and warm it a little. Have plenty of room, so that you can turn the affair (should it be a backbone). Place some of the mixed spelter and borax on the work, and commence to blow; when it gets to a dull red, throw a little borax on; this will help the metal to flow. Keep up a gentle blowing till you see the spelter run; then turn the work over carefully, and put a little more spelter on. Blow this until it has run down (assist it with borax), and rub off the superfluous metal; cease blowing, and, after a few seconds, lift it carefully off to examine, and to see if the spelter has gone all round; if not, you must go over it again, giving special attention to that part. I might say that, if you think it difficult to turn the work, you can work the spelter under it by means of the rod previously mentioned, which you must keep dipped in cold water, or it will pull the spelter off.—R. A.

Motors.—METAL.—Articles on Electric Motors appeared in WORK, Nos. 109 and 154.

Knotting, Splicing, and Working Cordage.—T. H. (*Huddersfield*).—Articles appeared in WORK, Nos. 105, 109, 113, 117, 120, 124, 127, 131, 139, 143, 147, and 150.

Scene Painting, etc.—E. C. (*Kirkdale*).—Articles on Scene Painting appeared in WORK, Nos. 92, 95, 97, 101, and 103; on Graining, in Nos. 55, 58, 62, 65, 69, 72, 76, 79, 85, 89, 93, 95, 98, 100, and 103; on Stage Carpentry, in Nos. 140, 144, 149, and 154.

Old Violin.—W. L. (*Hitchin*).—Bull, of Windmill Street, London, does not hold high rank amongst the English makers; but one frequently

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finds a beautifully made violin from the hands of a maker who is not in great repute. If the violin is in a fair state of preservation, I should think it would be worth while to have it put into playing order; but without first seeing an instrument, it is impossible to give a correct estimate of its value.—B.

Improvements in the Steam Engine.—INVENTO.—To give our correspondent satisfactory information in reply to his query would require us to write a treatise on the history of the steam engine, which would demand more space than could be found in our pages to do so, seeing that the steam engine is applied to so many different purposes, in many of which great general improvements have been introduced to fit them for the required purposes. For example, there is the marine engine, with all its gradual developments and improvements which have produced the magnificent examples of the present day. Then there are the pumping engines, mill engines, electric light engines, and others for stationary use; the locomotive and its gradual and progressive development; the steam fire engine, the traction engine, and other applications of steam which have required special arrangements and developments to enable them to be applied to the various uses where the aid of steam is required, and each and all of these embody "general improvements on the first invented engine" of a more or less extended character. If our correspondent is within a reasonable distance of a scientific library he should read the various histories of, and treatises on, the steam engine which have been published, and are generally to be found in such. For example, Farey on the steam engine; Dr. Lardner, on the same subject; Dr. Clark's excellent works on the locomotive; Seaton's treatise on the marine engine—one of the best works on this subject; also J. G. Winton on the steam engine; Young's "Fires, Fire Engines, and Fire Brigades," which treats on steam fire engines: and many others, which embody more or less the "general improvements" in the use of steam since it was first known as a motive power some one hundred and twenty years or so B.C.—C. E.

On Testing Precious Stones.—LEARNER.—To test precious stones is a difficult and complicated matter. To be a good judge of precious stones, much study and a great deal of practice are necessary. That it is possible to use rough tests, which will be useful, is not questioned. Let me recommend a book, written by Professor A. H. Church; it is called "Precious Stones." If deeper knowledge is desired, then mineralogy should be studied, because that science is the one that deals with precious stones. Even in the elementary stage students are taught how to find the specific gravity of an article, and to apply other scientific tests as well. To draw an instance of what specific gravity can do: it can decide for us whether a stone is an Oriental—*i.e.*, a true—ruby or a spinel, a Siam ruby or a Cape. It will at once let us know if a topaz is an Oriental topaz, or a Brazilian or a Scotch topaz, the three being entirely different in specific gravity—and in value, too.—H. S. G.

Making Threefold Screen.—SCREEN.—As regards the woodwork of your projected screen, you will find useful directions, with diagrams, in Vol. II., page 618 (No. 91). For ornamental tops, see Vol. IV., page 206 (No. 169). As regards hinging, there are directions for doing this with webbing at the page first named; brass hinges will, however, work better, if you do not mind the cost, for they are rather expensive. They are made specially for the purpose to turn both ways. If your ironmonger has not got them in stock, he can probably show you lithographs of them and get them for you. From what you say of your design, I imagine you will do best to paint in ordinary tube oil colours, covering your frame with such canvas as is used for pictures; this you will buy by the yard, ready prepared, at any good artists' colour shop. Be sure that you stretch it tightly. A more æsthetic screen might undoubtedly be made by using "tapestry" colours on the special tapestry canvas. All materials for this "tapestry painting" may be got at Howell & James's, or at Lechertier, Barbe, & Co.'s, both of Regent Street, London, W.C. But the process is as much one of staining as of painting, and I doubt whether you could rely on succeeding in a first attempt.—S. W.

III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

Cycle Wheel Repair.—A. M. (*Glasgow*) writes:—"Could any kind reader of WORK inform me the best way of repairing a buckled bicycle wheel? Would hollow rims be any advantage for hiring-out purposes?"

Tender Feet.—E. S. (*No Address*) writes:—"Can any reader of WORK give me information concerning a pneumatic inner sole for boots made of hollow indiarubber inflated with air? I am a great sufferer, having to stand for twelve hours each day on my feet."—[Try horse-hair sock.—ED.]

Polish.—WALNUT writes:—"Will someone kindly tell me what colour to mix with French polish when polishing walnut, as I want to get it darker than the natural wood is when polished."

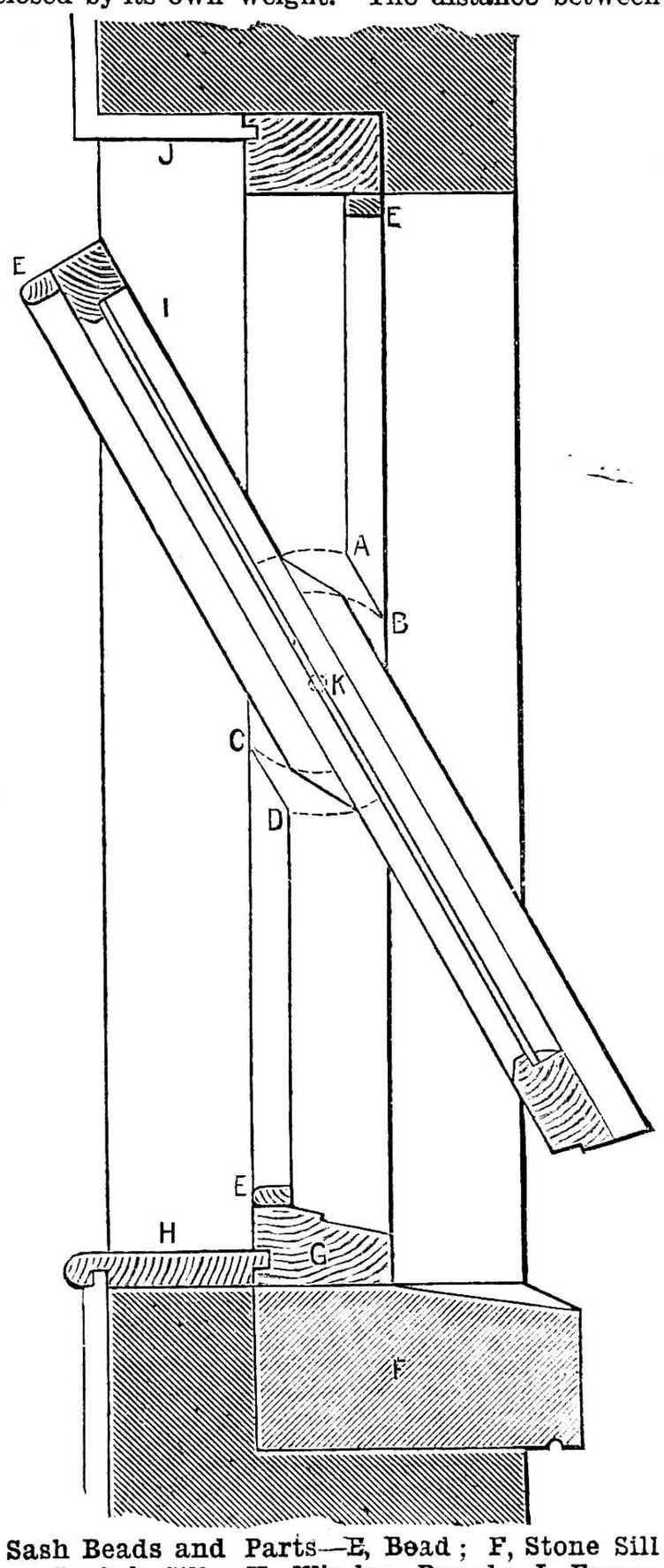
Couch.—C. R. (*Nottingham*) writes:—"I should very much thank anyone of my fellow-readers to give me a sketch, with the sizes, of a spindle-backed couch, the more elaborate the better?"

Gardener's Emblem.—GAEL writes:—"Could any reader give me a design for a gardener's emblem? I would like a floral design in fretwork about 10 in. by 8 in., introducing the letters B. O. A. F. G. Our Lodge is named the 'Bonnie Thistle.' Possibly the compass, set-square, and pruning-knife could be embodied."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Model Screw Steamship.—M. (*Bishop Auckland*) writes to A. B. (*Leith*) (see No. 163, page 110):—"You will find a method of drawing the hull of a model steamer in No. 71, Vol. II., of WORK. I should not attempt more than two propellers on so small a model. Yellow pine, free from knots and strakes, will be a suitable wood."

Sash Beads.—PRACTICAL (*London*) writes, in answer to H. F. (*Ramsbury*) (see No. 171, page 238):—"The distance between the two lines, A B and C D, must be wide enough to let sash pass between and be fitted on to the pivot; which pivot should be slightly above centre of sash, so as to keep it closed by its own weight. The distance between



Sash Beads and Parts—E, Bead; F, Stone Sill; G, Oak Sill; H, Window Board; I, Frame; J, Head; K, Pivot.

A B and C D having been settled, all that remains is to strike out circles with the pivot as centre and distances to A, B, C, and D respectively as shown for the radii; where these cut the bead on sash gives the points of intersection; with scriber and rule join these points and cut as required. I think H. F. will find it clear from sketch."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—S. P. (*Whitechapel*); J. A. (*Thirsk*); J. W. G. (*Keighley*); T J. B. (*Heywood*); S. S. (*Grantham*); A. B.; H. G. (*Coventry*); F. B. (*Greenwich*); A. M. A. T. (*Plaistow*); W. J. (*Ruddington*); C. G. W. (*Knutsford*); MENDALL; BLACKPOOL; H. C. M. (*Liverpool*); A. F. (*Luton*); W. W. C. (*New Kent Road*); G. S. (*Windsor*); G. V. (*Stepney, E.*); V. D. (*Portsdown Road*); J. H. C. (*East Ham*); READER OF "WORK"; VELO; JACK PLANE; C. T. (*Edinburgh*); G. T. (*Leeds*); ANXIOUS ENGINEER; STEEL WIRE; W. V. (*Tavistock*); E. A. (*Treharris*); AMATEUR; G. F. H. (*Wandsworth*); OLD READER; E. W. C. (*Leicester*); W. E. (*Notting Hill*); H. B. (*Spring Hill*); J. C. (*Dundee*); W. J. Z. (*Winchester*); F. J. K. (*Tufnell Park, N.*); NEWBIGGIN FISHER LADDIE; F. D. (*Birmingham*); OLD SUBSCRIBER; J. E. (*Wolverhampton*); D. J. K. (*Roscommon*); FLY; A. R. T. (*Birmingham*); J. G., JUNR. (*Castle Rankin*); J. G. R. (*Ampthill*); ANGLO-AUSTRALIAN; G. F. D. (*York*); R. R. F. (*Frome*); H. S. (*London, N.E.*); WOODSPOILER; C. E. M. (*Finsbury*); IMPROVER; G. F. (*Middlesbro'*); J. T. J. (*Manchester*); FACTORIAN; S. F. G. (*Fenton*).

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